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FOOD WASTE ON ASSORTED STAKEHOLDERS TOWARDS A GREEN ECONOMY FOOD SECURITY

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ABSTRACT

Indonesia is the country with the second highest level of food waste in the world and the first in Southeast Asia. Therefore, Indonesia has the highest Global Hunger Index in Southeast Asia, second only to Timor Leste. This condition has continued to increase over the last twenty years compared to food loss. Therefore, Indonesia is increasingly vulnerable to food shortages. Food waste needs to be minimized to help meet future food needs. The aim of this research is to identify the factors that underlie consumer behavior in wasting food. Interviews were conducted with 273 respondents, especially in West Kalimantan, Indonesia. The collected data was then analyzed using Structural Equation Modeling (SEM) through the AMOS 24 program. The findings in this research show that the five factors underlying consumer behavior, namely: food choices, shopping routines, food handling, waste prevention behavior, and recycling behavior have a negative effect. and significant to the amount of food waste. This means that, the better the food choices, shopping routines, food handling, waste prevention behavior, and recycling behavior, the smaller the amount of food waste produced. Other findings show that waste prevention behavior has the greatest influence on food waste. Efforts that consumers can make to reduce the amount of food waste at the household level are by increasing knowledge about good food choices, improving skills in processing and storing food, and committing to making a list of needs before shopping and complying with it.

Keywords: *consumer behavior, food waste, West Kalimantan*

BACKGROUND

Food waste from agriculture can be minimized by making good use of the food supply (FAO, 2013). The amount of food waste in Indonesia increases every year compared to the amount of food lost (BAPPENAS, 2021). The Ministry of Environment and Forestry in the National Waste Management Information System states that 38.38% of the total waste generated in Indonesia is generated by households (KLHK, 2022). Most of them are dominated by food waste, amounting to 40.7% of the total amount of waste produced. Food waste is residue generated during the supply chain process and has long been a global problem (Blešić et al., 2021). Food waste is described as materials produced but lost or wasted, for example unsold food or leftover food for human consumption (Chen et al., 2015). Food waste is caused by a variety of causes, including human awareness and behaviors. One of the primary reasons of food waste is consumer behavior (Schanes et al., 2018).

Indonesia produces 20,938,252 tonnes of food waste per year, making it the second largest producer of food waste in the world and the highest in Southeast Asia (Brack et al., 2015; O'Connor et al., 2021). These losses reached 4-5% of Indonesia's GDP, equivalent to the food needs of 29-47%

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of Indonesia's population (BAPPENAS, 2021). On the other hand, Indonesia is ranked second after Timor Leste with the highest GHI (Global Hunger Index) score in the Southeast Asia region (Grebmer et al., 2021). This large amount of food waste causes various negative impacts on social, economic and environmental conditions (Graham-Rowe et al., 2014). Socially, it can result in an increase in food prices because food availability is difficult and results in a shortage of food and can lead to hunger and malnutrition. The magnitude of economic losses due to food waste from agricultural products based on producer prices is around 750 billion USD (FAO, 2013). The impact of food waste on environmental conditions is related to high greenhouse gas emissions (WRAP, 2009). According to Thyberg and Tonjes (2016) and FAO (2013), food waste is known as a source of greenhouse gas emissions. Indonesia ranks third after the United States and China in the list of largest emitting countries (FAO, 2011). According to BAPPENAS (2021), over 20 years (2000-2019), food waste in Indonesia contributed an average of 7.29% of the country's annual GHG emissions.

Food waste has been the subject of extensive investigation up to this point. Most research on waste generation behavior at the consumer level was conducted in developed countries (Graham-Rowe et al., 2014; Russell et al., 2017; Richter, 2017; Stancu et al., 2016). Meanwhile in Indonesia, research related to food waste is still limited to the amount of waste that occurs in certain commodities (Saputro et al., 2021; Roidah Afifah, 2018). The model commonly used to determine the factors that influence waste generating behavior at the consumer level is the Theory of Planned Behavior (Ajzen, 1991). However, the factors that influence consumer food waste cannot be predicted accurately using the Theory of Planned Behavior (TPB) (Afifah et al., 2018). Several studies added several socioeconomic constructs and consumer skill factors such as meal planning, shopping activities, food serving, food waste handling, food waste storage and disposal methods to increase the predictive value of the model (Thyberg & Tonjes, 2016; Diaz-Ruiz et al., 2018; Hidayat et al., 2020; Ozanne et al., 2022).

In this study, we employ a model adopted from Diaz-Ruiz et al. (2018). The variables in this research are food choices, shopping routines, food handling, waste prevention behavior, and recycling behavior. The Diaz-Ruiz model was chosen because the factors used in this research are the results of studies from previous research. The novelty of this research lies in the data analysis tools used and the respondents who are the research objects. Data analysis uses SEM-AMOS to analyze factors that influence consumer behavior towards food waste. Therefore, this research was conducted with the aim of testing what factors influence consumer decisions regarding food waste. It is intended that this study will add to the body of knowledge about the factors influencing household behavior in developing nations particularly Indonesia with regard to food waste. Province of West Kalimantan is more concentrated.

RESEARCH METHODS

This study was conducted in several West Kalimantan locations. The deliberate or purposeful decision of location is based on the percentage distribution of the population by Regency/City (BPS, 2021). Regency/City areas that are the data source are then grouped into three groups. Districts with a high percentage of population distribution include Pontianak City and Kuburaya District. Districts with moderate population distribution percentages include Ketapang Regency and Sanggau Regency. Meanwhile, districts with low population distribution percentages include Mempawah District and

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Landak District. The survey method was used in this research with data collection tools in the form of questionnaires and in-depth interviews with 273 respondents who were households.

Convenience sampling was the methodology employed in the non-probability sampling method used to determine the sample. Convenience sampling is a sampling technique that is carried out based on the respondent's willingness to participate and is easy to reach or obtain. This method was chosen as an alternative to simple random sampling which was not possible to use due to limited research time, difficulty in meeting respondents, and cost efficiency. By using this method, respondents who are interviewed depend entirely on the convenience of the researcher and the selection of respondents who are considered suitable as data sources. The criteria for whether the respondent is suitable or not are based on the following criteria:

1. Household level respondents who live in districts/cities in West Kalimantan are Pontianak City, Kuburaya Regency, Landak Regency, Sanggau Regency, Mempawah Regency, and Ketapang Regency.
2. Knowing household consumption behavior.
3. Willing to be interviewed for research purposes

A total of 273 respondents were obtained through interview techniques. Sampling was carried out over a period of three months from April to July 2023. Data analysis in this study used SEM (Structural Equation Model) with the AMOS 24 program. Data analysis included validity, reliability, model suitability, and hypothesis testing. This research uses primary data which needs to be tested for the validity and reliability of the data with the minimum requirement to be considered valid if the instrument has an r value ≥ 0.5. The overall coefficient r ≥ variable is 0.5, meaning the research instrument is valid. Data analysis uses the SEM method, including:

1. Model development
2. Flow Diagram Development
3. Flow Diagram conversion to SEM Equation

Selecting the Input Matrix and Estimation Techniques

The covariance matrix is the matrix used as SEM input because this research will evaluate cause and effect relationships. Explanation or prediction of the phenomenon under study is carried out using a covariance matrix. Maximum likelihood is an estimation method applied in accordance with the parameters of the 100–200 member sample under evaluation.

Model Evaluation

This step assesses the model's correctness using a progression of goodness of fit criteria. The following is the conformance test model:

Table 1. The Conformance Test Model

Goodness of Fit Criteria	Accepted Value
X^2–Kotak Chi	Field Chi < x^2 table
Probability	<0,05
RMSEA	<0,08
GFI	≥ 0,9
CMIN/DF	2<CMIN/DF<5
AGFI	≥ 0,90
TLI	≥ 0,90

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Finance	≥ 0,95
PNFI	> 0,90
PFI	> 0,90

Model Interpretation

Researchers are still able to make modifications to the model they are constructing even if the appropriateness test indicates that certain conditions are not satisfied. The formulation of something is called a hypothesis, and can guide additional research as well as be used to explain it.

RESULT AND DISCUSSION

Descriptive statistics provide a simple summary of the mean value, standard deviation, and percentage distribution of answers on the questionnaire instrument for each indicator on the variables in the respondent's research which are shown in Table 2.

Table 2. Food Waste Produced

Variabel _	Value	Standard Deviation	Distribution of Respondents				
			1	2	3	4	5
Food selection (X1)							
It is important for me to consume foods rich in vitamins (X 1.1).	4,16	0,95	0,73	5,13	18,32	28,57	47,25
I consider eating low-fat foods to be crucial (X1.2).	3,85	0,94	0,73	5,86	31,14	32,23	30,04
I think it is important to eat food that does not contain harmful substances such as pesticides (X 1.3)	4,27	0,91	0,73	3,66	15,75	27,47	52,38
Shopping Routines (X2)							
Commonly, I only buy things I really need (X 2.1)	4,07	1,04	4,76	2,56	14,65	36,63	41,39
I write down a list of things I need before shopping and stick to it (X 2.2)	3,82	1,00	2,93	5,86	25,64	37,36	28,21
I create my consumption strategy in the coming days so that I can buy effectively (X 2.3)	3,71	1,01	3,66	6,59	27,84	38,46	23,44
Food Handling (X3)							
I ate the rest the next day (X 3.1)	3,44	0,71	0	7,33	47,62	39,19	5,86
I process leftover food into new dishes by adding a number of additional/complementary ingredients (X 3.2)	3,38	0,72	0	8,79	49,45	36,63	5,13
I preserve food leftovers properly so they can be used again (X 3.3)	3,49	0,70	0	5,49	46,52	41,39	6,59
Waste Prevention Behavior (X4)							
I use my own shopping bag when shopping, and avoid using plastic bags (X4.1)	2,93	1,31	15,02	28,21	21,61	19,05	16,12
Instead of buying disposable items, I choose to buy products that can be	3,36	1,26	6,96	21,25	27,11	18,68	26,01

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Variabel _	Value	Standard Deviation	Distribution of Respondents				
			1	2	3	4	5
used repeatedly (X 4.2)							
I'm trying to fix things instead of buying new ones. (X 4.3)	3,22	1,30	9,89	24,54	21,61	21,98	21,98
I utilize/use recycled paper waste (X4.4)	3,27	1,27	8,06	24,18	21,98	23,81	21,98
Recycling Behavior (X5)							
I recycle paper (X5.1)	3,80	1,05	3,30	8,79	20,51	39,19	28,21
I recycle packaging (X5.2)	3,72	0,97	2,56	6,59	30,40	37,36	23,08
I recycle organic waste (X5.3)	3,67	0,98	3,30	7,33	28,57	40,66	20,15
Food Waste (Y)							
There are a lot of food waste in my trash can (Y1)	2,14	1,03	28,57	42,49	20,15	4,03	4,76
Number of foods I threw away recently because they were rotten (Y2)	1,88	1,10	52,75	18,68	19,05	6,59	2,93
I had to throw out a lot of food in the last week or two due to my forgetfulness because it was spoilt (Y3)	2,12	1,06	37,36	25,64	26,74	8,42	1,83
Number of foods I threw away recently because I prepared or bought more than necessary (Y 4)	2,09	1,04	35,53	31,87	23,08	6,96	2,56
Number of foods I threw away in the previous week or two due to leftover food I didn't eat later (Y 5)	2,22	1,21	38,10	23,08	21,98	12,09	4,76
Number of foods I threw away in the last week or two due to stockpiling too much and then consuming too little (Y 6)	2,14	1,10	35,16	30,04	24,54	5,86	4,40

According to Table 1, the three manifest variables' mean values for the food choice variable range from 3.85 to 4.27 on five Likert scales. The value indicates that the respondent's dietary preferences range from neutral to in agreement. Most respondents said it was critical to select foods high in vitamins, low in fat, and devoid of potentially harmful additives. Respondents' shopping habits are typical. Using five Likert scales, the average rating for a shopping routine ranges from 3.71 to 4.07. This number, which falls between agree and strongly agree, indicates that the respondent has organized and followed a shopping list for their regular shopping trips. The three manifest factors related to food handling have mean values that range from 3.38 to 3.49 on five Likert scales. This number, which ranges from indifferent to agree, shows that the respondent has handled leftover food with great care.

The waste prevention behavior construct has a mean value for the four manifest variables ranging from 2.93 to 3.36 from five Likert scales. This mean value is on a scale of rarely and sometimes, which illustrates that on average respondents carry out waste prevention in rare and sometimes intervals. In the recycling behavior construct, the three manifest variables have mean values ranging from 3.67 to 3.80 from five Likert scales. This value is on a scale between sometimes to almost often. This indicates that on average respondents have a good attitude in recycling paper,

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packaging and organic waste. Lastly, the food waste construct is measured with six manifest variables using a Likert scale with five levels of preference. The mean value obtained was 1.86 to 2.22. This value is between none to very little. This measurement illustrates that respondents in this study threw away very little or almost no food.

Validity and Reliability Test

The CFA test results will be shown by the Standardized Regression Weights value if the valid indicator is greater than 0.5. In the meantime, the criteria of CR values > 0.7 and AVE > 0.5 were used to calculate the CR and AVE values in order to conduct the reliability test.

Table 3. CFA Analysis Results Table

		Variable	Estimation
X1.1	←	Food Variety	0,830
X1.2	←	Food Variety	0,788
X1.3	←	Food Variety	0,753
X2.1	←	Shopping habits	0,766
X2.2	←	Shopping habits	0,756
X2.3	←	Shopping habits	0,649
X3.1	←	Food Management	0,854
X3.2	←	Food Management	0,885
X3.3	←	Food Management	0,796
X4.1	←	Waste Prevention Behavior	0,928
X4.2	←	Waste Prevention Behavior	0,911
X4.3	←	Waste Prevention Behavior	0,921
X4.4	←	Preventive Behavior	0,925
X5.1	←	Recycling Behavior	0,817
X5.2	←	Recycling Behavior	0,831
X5.3	←	Recycling Behavior	0,795
Y1	←	Food waste behavior	0,675
Y2	←	Food waste behavior	0,712
Y3	←	Food waste behavior	0,791
Y4	←	Food waste behavior	0,743
Y5	←	Food waste behavior	0,719
Y6	←	Food waste behavior	0,703

It is evident from the aforementioned data that every Standardized Regression Weights estimated value for every indicator for every variable satisfies the significance threshold, indicating that each indication has a significant impact on the variable.

Table 4. Reliability Test

Endogen Variables	Kr	Path
Food Variety (X1)	0,7	0,7
Shopping Habits (X2)	0,8	0,5
Food Management (X3)	0,9	0,8
Waste Prevention Behavior	0,9	0,8
Food waste behavior	0,9	0,7

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Table 4 demonstrates that every CR value satisfies the CR > 0.7 dependability criteria. Since every endogenous variable's AVE value is greater than0.5, the dependability requirements are satisfied. This suggests that all of the exogenous latent variables that were employed in this study adhere to reliability guidelines.

Structural Equation Modeling (SEM) Analysis

The fit model for the research was created using the goodness of fit test for SEM-AMOS analysis in accordance with the predetermined GOF value criteria. The GOF values used in the model fit of this study are listed below.

Table 5. Table GOF

Index	Cut off Value	Result	Evaluation Model
Chi – Square	minimal size	341.902	Not Fit
Prob	≥ 0,05	0,000	Not Fit
CMIN/DF	≤ 2,00	1.762	Good Fit
RMSEA	≤ 0,08	0,053	Good Fit
GFI	≥ 0,90	0,900	Good Fit
AFGI	≥ 0,90	0,870	Marjinal Fit
TLI	≥ 0,95	0,960	Good Fit
CFI	≥ 0,95	0,974	Good Fit

Based on the table above, it can be seen that there are still models that are not yet fit, namely Chi-square and Probability. A model that is not yet fit does not mean the model cannot be used at all. According to Santoso (2014), model modifications can be carried out by adding correlations according to the recommendations in the AMOS SEM output results that have been carried out. This stage is carried out by adjusting the model from the Modification Indices table from the AMOS analysis results. The Modification Indices used to create the fit model for this investigation are shown in the following table.

Table 6. Modification Index Table

			MI	Modification Par
e17	<-->	e18	11.622	0,133
e16	<-->	e17	17.066	-0,134
e5	<-->	e16	10.454	-0,104
e5	<-->	e15	17.896	0,129

Modification of the model is carried out by connecting manifest variables or manifest variables with latent variables.

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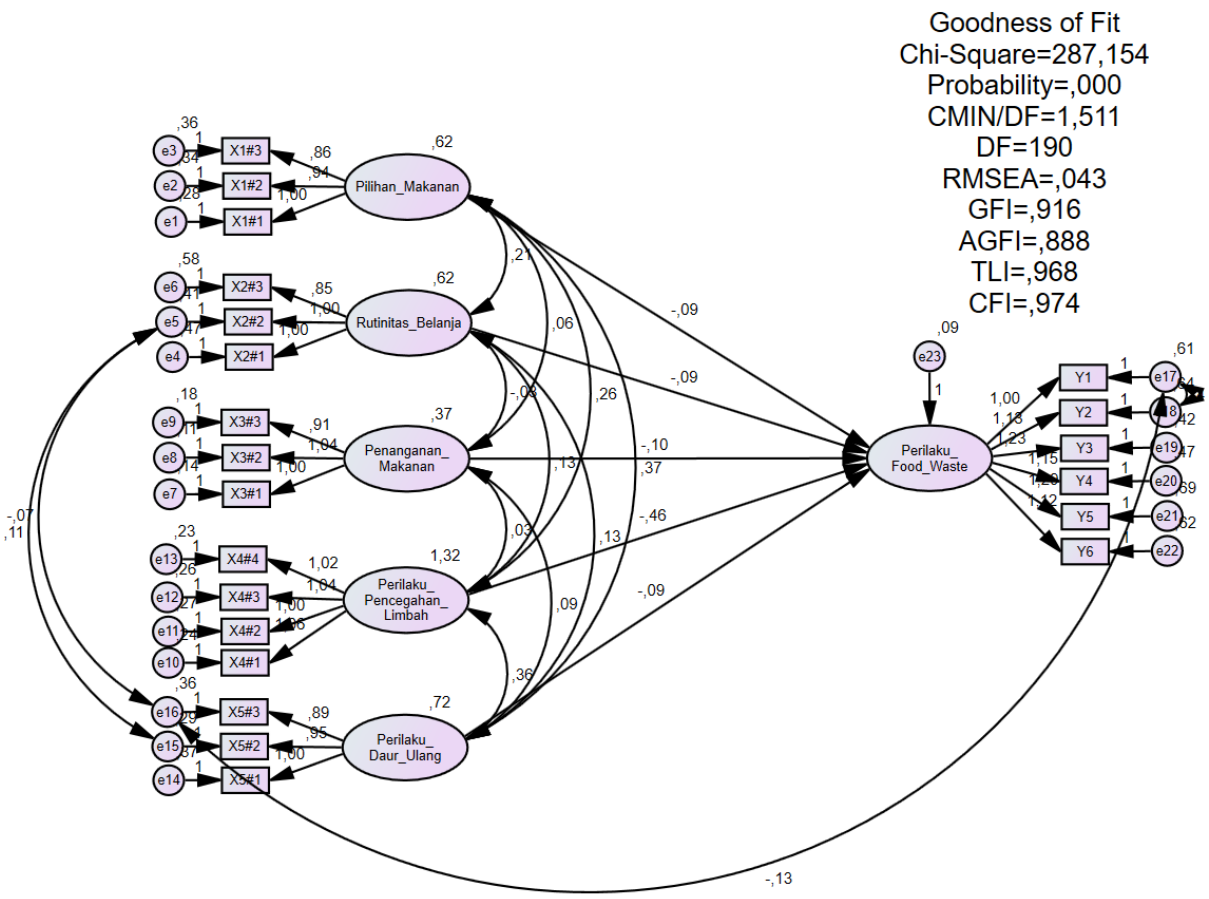

Figure 1. Final Results of the AMOS SEM Model

Results reveal that the modified model fits the data very well. The Goodness of Fit indicator shows the suitability of the proposed final model. Table 6 presents the GOF test results after modifications in the study.

Table 7. Goodness of Fit Test

Index	Cut off Value	Result	Evaluation Model
Chi – Square	Minimal Size	287,154	Good Fit
Probability	≥ 0,05	0,000	Not Fit
CMIN/DF	≤ 2,00	1,511	Good Fit
RMSEA	≤ 0,08	0,043	Good Fit
GFI	≥ 0,90	0,916	Good Fit
AFGI	≥ 0,90	0,888	Marjinal Fit
TLI	≥ 0,95	0,968	Good Fit
CFI	≥ 0,95	0,974	Good Fit

CFA tests and feasibility tests were completed before SEM tests. Checking the values in the regression weights table is one approach to doing this. The results of hypothesis testing in table 7 show that partially, all exogenous constructs X1, ,1 (Bahri & Zam-Zam, 2015). The probability value *** in the Regression Weight table shows that the probability value is <0.00. This shows that the influence of the indicators on the variables is very good. because the smaller the probability value, the more significant the influence of the indicator on the variable being measured.

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Table 8. Hypothesis Testing

Hhypothesis	Path Correlation	Estimate	CR	P-Value	Remark
H1	Food Selection → Food Waste Behavior	-0,089	-1,812	0,07	Accepted
H2	Shopping Routine → Food Waste Behavior	-0,092	-2,235	0,025	Accepted
H3	Food Handling → Food Waste Behavior	-0,095	-2,049	0,04	Accepted
H4	Waste Prevention Behavior → Food Waste Behavior	-0,458	-11,154	***	Accepted
H5	Recycling Behavior → Food Waste Behavior	-0,086	-1,920	0,055	Accepted

This study examines five factors that are associated with food waste. Food selections, purchasing habits, food handling, waste avoidance, and recycling practices are these five variables. The study's conclusions show that purchasing habits, food handling practices, and waste avoidance behavior variables are the primary factors influencing food waste. This study demonstrates that consumers have a relatively high level of domestic waste prevention behavior. In line with research by Diaz-Ruiz et al. (2018) shows that consumer environmental awareness can be specified into waste prevention behavior, which in this research is demonstrated by consumer behavior of buying products that can be used repeatedly rather than products that can only be used once, trying to repair goods before buying new ones and using/reusing used paper.

The second direct predictor of food waste is shopping routine. In this research, the results of the analysis show that respondents' habits in planning and being disciplined in shopping activities will influence the amount of food waste produced. The better the planning and discipline in shopping, the less food waste the household will produce. Respondents with good shopping routines tend to only buy the items they need, make a shopping list and stick to it, and plan their consumption so they can shop efficiently. These findings are in accordance with research conducted by Richter (2017) which stated that a good shopping routine influences the level of food waste that occurs.

Food handling in this case means the respondent's skills in treating food in the storage and processing process have a strong influence on food waste. The average factor loading on this variable is 0.82. The indicator with the highest factor loading value is storing food in appropriate conditions so that it can still be used properly. These findings are in accordance with research conducted by Richter (2017) which states that one of the factors that influences food waste among consumers in Germany is the handling of food with an average factor loading of 0.66.

In addition to the three primary variables mentioned above, there exist additional determinants that impact the amount of food waste generated by households' consumers. The findings in this study reveal that food choices are known to be a direct determinant of food waste. This means that the better the respondent's food choices, the less household food waste they produce. The results of the analysis show that consuming vitamin foods greatly influences the food waste behavior of West Kalimantan household consumers. The research results illustrate that respondents who have good habits in food choices will tend to regret if the food is left over and wasted, so this reduces the opportunity for increasing the amount of food waste in the household. These results are in accordance with research conducted by Abdelradi (2018) which states that food choices have a significant influence on food

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waste. This food selection is related to consumer knowledge of important attributes of food such as nutritional content and food quality.

Recycling practices are another factor that impacts food waste behavior in homes. Because recycling can reduce trash, recycling behavior and environmental concern are directly associated (Barr, 2007; Kilbourne and Pickett, 2008). The findings in this research show that recycling behavior has a significant influence on the food waste behavior of household consumers in West Kalimantan. Consumers in West Kalimantan on average have a good attitude towards recycling paper, packaging and organic waste. This is in line with research by Diaz-Ruiz et al. (2018) which shows that the higher environmental awareness shows positive recycling behavior, this will minimize food waste for household consumers.

CONCLUSION AND SUGGESTION

Food wastage is becoming into a major worldwide issue, right alongside the issue of world hunger. In Indonesia, 13 million tons of food are wasted annually, which is a substantial quantity. Hotels, restaurants, catering, supermarkets, retail stores and customers who do not finish their food are the main sources of this food waste. This study increases knowledge about the variables that influence consumer behavior around food waste in developing countries, especially in Indonesia. This research was conducted in West Kalimantan Province and concentrated on consumers at the household level. The research results show that food choices, shopping routines, food handling, waste prevention behavior, and recycling behavior have a negative and significant effect on the amount of food waste. This negative influence means that the better the food choices, shopping routines, food handling, waste prevention behavior and recycling behavior, the smaller the amount of food waste produced. The three key factors that influence food waste from these five variables are waste prevention behavior variables, shopping routines, and food handling.

The results of this study offer a number of recommendations for lowering food waste levels in households. First, because waste prevention behavior is a behavioral predictor with the highest value, to reduce the amount of food waste produced, efforts that can be made by consumers at the household level are to increase knowledge about good food choices, and buy products that can be used repeatedly. Second, related to shopping routines which are a direct predictor of waste prevention. Therefore, the home level effort that consumers can undertake to decrease food waste is to develop a list of needs and stick to it before going grocery shopping. Third, food handling is the final significant factor. Customers can endeavor to decrease the quantity of food waste generated in their homes by honing their abilities to prepare and preserve food in ways that preserve its nutritional value.

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