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MORALITY BEFORE KNOWLEDGE

Analyzing the environmental readiness of coffee shop entrepreneurs: A study using the PLS-SEM approach and the theory of reasoned action

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ABSTRACT

Background: The rapid growth of the coffee industry has increased consumption and the generation of spent coffee grounds waste, which poses environmental risks while offering economic potential. Although previous studies have discussed the hazards and benefits of this waste, comprehensive research on coffee shop entrepreneurs' readiness to adopt environmentally friendly behavior remains limited. This study aims to examine their readiness by analyzing the influence of awareness, knowledge, attitude, intention, and actual behavior, based on the Theory of Reasoned Action. **Methods**: A quantitative approach with a cross-sectional design was used. Data were collected in 2022 from 200 coffee shop entrepreneurs in Jakarta and Bekasi, selected as central coffee business areas. Partial Least Squares (PLS) analysis was conducted, including outer model, goodness-of-fit, and inner model tests. **Findings:** The results showed that environmental awareness had no significant direct or indirect effect on environmentally friendly behavior. In contrast, knowledge significantly influenced the formation of positive attitudes, which mediated the relationship with intention and actual behavior. These results underscore the need to distinguish between awareness and knowledge, as only the latter demonstrated a meaningful impact on behavior formation. Well-informed attitudes enhanced behavioral intention, which in turn significantly influenced actual pro-environmental behavior. These findings validate the Theory of Reasoned Action and extend its applicability in explaining pro-environmental behavior adoption in waste-management-based entrepreneurship, particularly in coffee shop businesses. **Conclusion**: The study highlights the importance of environmental and entrepreneurial education regarding both the risks and economic potential of spent coffee grounds. Government support is needed to promote education, build enabling systems, and provide infrastructure to foster environmentally responsible behavior. **Novelty/Originality of this article:** This study offers a novel contribution by examining coffee shop entrepreneurs' environmental readiness using the Theory of Reasoned Action and a PLS-SEM approach. Unlike prior studies that focused on the risks and benefits of spent coffee grounds, this research explores the behavioral pathway from awareness and knowledge to actual pro-environmental practices, highlighting the distinct roles of both.

KEYWORDS: actual behavior; attitude; awareness; intention; spent coffee grounds.

1. Introduction

The coffee industry in Indonesia has experienced rapid growth in recent years, making it one of the leading commodities produced on a large scale. Not only in the production process, but coffee consumption has also seen a significant increase, marked by the proliferation of coffee shops in various regions. It is estimated that coffee consumption in Indonesia will reach 4.8 million bags (1 bag= 60 kg) by 2024/2025, driven by a wider variety of products at affordable prices, supported by diverse distribution networks such as

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supermarkets, convenience stores, local small retailers, and kiosks (USDA, 2024). The Goodstats survey also shows that 71 percent of coffee enthusiasts in Indonesia prefer to buy coffee rather than brew it themselves, with Kopi Kenangan being the most favored coffee shop, followed by Fore Kopi and Starbucks (Goodstats, 2024).

The rising trend in coffee consumption not only impacts the economy but also has environmental consequences, such as coffee grounds waste from production. The utilization of coffee and many other resources in Indonesia generally still follows the cradle-to-grave concept. This concept reflects unsustainable products, as energy and resources are extracted from the environment for temporary use, and the waste from consumption ends up in landfills, incinerators, or pollutes the environment (Srebotnjak, 2019). Data from the National Waste Management Information System/*Sistem Informasi Pengelolaan Sampah Nasional* (SIPSN) shows that by 2023, waste generated in Indonesia will continue to increase annually (Ministry of Environment and Forestry, 2025). This increase in waste has not been matched by adequate waste management, with only 47.3 percent of total waste being managed by 2023. Nearly half of the waste composition consists of food waste, accounting for 39.71 percent. The commercial sector ranks third as the largest source of waste, closely followed by offices. In the coffee industry alone, the average coffee grounds waste generated by coffee shops in one city per day reaches 585.71 grams (Mulyani et al., 2024). Unprocessed coffee grounds contain harmful compounds that can cause various issues such as DNA damage, toxicity to aquatic organisms (Fernandes et al., 2017), disrupt plant growth (Hechmi et al., 2023), and water pollution (Ulsido et al., 2024). These conditions highlight the need for greater attention to the processing and utilization of coffee grounds waste.

The reuse of waste generated by a product is part of the cradle-to-cradle concept. The scope of the cradle-to-cradle principle is to transform the material process in production from a linear form into a cycle, so that no waste is generated by utilizing residues in other stages of production (Meyer & Schneider, 2019). This concept mimics nature's sustainable cycles. Coffee grounds waste falls under the category of organic waste derived from living organisms, making it reusable by both nature and humans. Research has extensively demonstrated that coffee grounds can be processed into renewable energy such as biofuel (Jeníček et al., 2022), biorefinery (Johnson et al., 2022), and bioactive metabolites (Singh et al., 2023). Coffee grounds are beneficial in briquette production as they enhance combustion capacity and heating efficiency (Brunerov et al., 2020; Kim et al., 2022). The oil contained in coffee grounds serves as a specialized ingredient for skin-brightening products, wrinkle reduction, and improved skin elasticity (Kanlayavattanakul et al., 2021). In agriculture, coffee grounds serve as a sustainable fertilizer alternative that contributes to enhanced plant growth and soil quality, thereby supporting sustainable agricultural practices and the circular economy (Hechmi et al., 2023; Jeníček et al., 2022; Mesmar et al., 2024). This aligns with the cradle-to-cradle approach, which aims to promote positive innovation in economic, environmental, and social aspects of products and services (Meyer & Schneider, 2019). These findings demonstrate that coffee grounds waste processing not only benefits the environment but also holds economic potential. Therefore, it is important to assess the readiness of coffee shop operators to adopt environmentally friendly practices related to coffee grounds waste management.

Environmentally friendly behaviors such as sorting and recycling waste are not yet common practices in Indonesia. To encourage new behaviors, it is necessary to examine the factors that influence environmentally friendly behavior. Shah et al. (2021) revealed that an individual's intention to engage in environmentally friendly behavior is influenced by attitudes shaped by awareness and knowledge about the environment. Awareness and knowledge are initial cognitive conditions that exist in the mind but have not yet been translated into action. Awareness is associated with personally relevant information, while knowledge refers to information at a larger or smaller scale, detailed, and factual (Trevethan, 2017). A study conducted in 39 countries by Yang et al. (2021) shows that environmental awareness drives the intention to engage in environmentally friendly behavior. The study revealed an important finding: the motivation to engage in such

behavior can weaken due to the influence of normative social institutions such as local traditions, but it can also strengthen through the influence of cognitive social institutions such as education.

An individual's attitude toward the environment is an important predictor in determining environmentally friendly behavior. Marcinkowski & Reid (2019) state that fostering more environmentally friendly behavior is typically achieved by deepening and reprocessing the relationship between attitudes and behavior through environmental education. This occurs because the information received shapes an individual's attitude toward a particular matter. Research by Bechler et al. (2021) found that the relationship between attitudes and behavior is not linear; significant changes in attitudes do not necessarily result in significant changes in behavior. The relationship between attitudes and behavior can vary in strength depending on moderating factors. However, attitudes consistently influence behavior when they are formed based on information relevant to that behavior (Glasman & Albarracin, 2016). This highlights the connection between the information an individual possesses and how they perceive and ultimately behave.

Behavioral intention is a condition that precedes planned behavior, such as environmentally friendly behavior. It is not uncommon for a person's intention to do something to end up as just an intention without any action. Faries (2016) reveals that one of the causes of intentions not matching behavior is a person's capacity, which shows an individual's ability to manage their thoughts, attitudes, and behavior. According to Conner & Norman (2022), strong and stable intentions are predictors of behavior, but strong intentions can lead to biases in processing information about what one intends to do. At the industrial level, the success of implementing environmentally friendly behavior depends on workers' willingness to take environmental conservation actions, which can be influenced by increasing knowledge and awareness, thereby enhancing employees' intentions to engage in environmentally friendly behavior (Maqsoom et al., 2023).

Sustainable development in various industrial sectors is an agenda that is being promoted to achieve harmony between humans and the environment. The coffee industry, as a rapidly growing industry, continues to experience an increase in consumption as well as an increase in the amount of coffee grounds waste that requires collective concern. Research that has been presented shows the threat of coffee grounds waste to the environment as well as the economic potential that can be exploited from coffee grounds waste. The research gap in this study lies in the tendency of previous studies to focus on the dangers and benefits of coffee grounds, while there has been no comprehensive study exploring perceptions and measuring the readiness of coffee shop operators to adopt environmentally friendly behaviors. Therefore, this study aims to fill the research gap regarding the readiness of coffee shop business operators to manage coffee grounds waste in an environmentally friendly manner through the Theory of Reasoned Action (TRA) approach. The readiness of coffee shop business operators will be measured through an analysis of the influence of awareness and knowledge on attitudes, followed by behavioral intentions, and ultimately reflected in the actual behavior of coffee shop business operators regarding coffee grounds waste. Filling this research gap can identify effective strategies to improve coffee grounds waste management by addressing the behavioral aspects of business operators.

This study adopts the Theory of Reasoned Action, which has been further developed in the Reasoned Action Approach (Fishbein & Ajzen, 2010) to predict and understand behavioral changes by measuring intentions or behavioral readiness formed within individuals. This approach emphasizes that behavior is determined by intentions formed through internal factors such as attitudes. Although this model has been developed to accommodate external factors through the variable of perceived behavioral control, this study does not measure perceived behavioral control directly and remains focused on the components within the classical TRA framework. Based on theory and previous research, the awareness and knowledge of coffee shop business owners are suspected to influence the formation of attitudes, which then influence intentions to behave, and ultimately manifest through actual behavior. As the title suggests, this study discusses the behavioral

process beginning with awareness and knowledge that shape attitudes. These attitudes then influence behavioral intentions and the actual behavior of coffee shop business owners. The structure of this paper begins with an introduction that provides background and objectives for examining the environmental awareness of coffee shop business owners. Next, the methodology explains the data collection and analysis process. The results of the analysis and interpretation are discussed in depth in the results and discussion section. Finally, the paper concludes with a summary of the findings and implications for future research. The references used in this study are listed in the references section.

2. Methods

2.1 Research design and location

This study is a quantitative study with a cross-sectional design, or data collection at a single point in time. Data collection was conducted in Jakarta and Bekasi, which are central industrial areas in Indonesia, in 2022. Jakarta has experienced the most rapid increase in coffee shops compared to other cities. This was revealed by one coffee machine distributor company, stating that the increase in coffee shops in Jakarta reached 10 percent, while in other cities it was only 7 percent (Wartakotalive.com, 2018). The Bekasi region itself is referred to as an area with a relatively high purchasing power for coffee products, with one coffee shop able to sell 5,000 cups in a single month (Akbar, 2021). All coffee shop operators in the Jakarta and Bekasi regions constitute the population for this study. The sample was selected purposively from this population, with the criteria being coffee shop business operators in the Jakarta and Bekasi regions who were actively selling at the time of the study. The researcher interviewed coffee shop business operators using a structured questionnaire to assess their readiness to adopt environmentally friendly behavior by measuring awareness, knowledge, attitude, behavioral intention, and actual behavior.

2.2 Questionnaire and data collection

The questionnaire was divided into four sections to obtain information about the characteristics of coffee shop operators, coffee shop characteristics, waste management in coffee shops, and the level of readiness to adopt environmentally friendly behavior. The level of readiness to adopt environmentally friendly behavior was measured through 28 statements divided into five variables: awareness, knowledge, attitude, and behavioral intention. Each section has a different number of questions. All statements are responded to using a Likert scale with the following options: 1 = Disagree, 2 = Neutral, 3 = Agree, and 4 = Strongly Agree.

In this study, awareness refers to a person's initial perception of coffee grounds. This condition does not yet include a deeper understanding or information about coffee grounds. Statements regarding awareness consist of 10 indicators, namely: 1) Coffee grounds waste can cause water pollution, 2) Coffee grounds waste can be reused, 3) Coffee grounds waste still has benefits, 4) Coffee grounds waste still has economic value, 5) Coffee grounds waste is produced in the same amount as the coffee used, 6) Coffee grounds waste can be used to make briquettes, 7) Coffee grounds can be used for the production of cosmetic products, 8) Coffee grounds can be used as an energy source, 9) Coffee grounds can be an alternative business, and 10) Coffee grounds processing can be a profitable business.

Knowledge in this study measures an individual's understanding of coffee grounds. This includes factual information about coffee grounds and the environment. Statements regarding knowledge consist of 7 indicators, namely: 1) I know that coffee grounds still contain compounds that give coffee its aroma, 2) I know that coffee grounds still contain compounds that give coffee its taste, 3) Coffee grounds will decrease in value if mixed with other waste, 4) The utilization of coffee grounds must involve separating them from other waste, 5) Coffee grounds can be used as plant fertilizer, 6) Coffee grounds can be used as

cosmetic ingredients, and 7) Coffee grounds can be used as an environmentally friendly energy source.

Attitudes are related to a person's views on a particular matter, which in this study focuses on coffee grounds. Attitudes are formed through the information and experiences that each person has. Statements regarding attitudes consist of six indicators, namely: 1) Coffee grounds are separated from other waste so that they can be reused, 2) The use of coffee grounds will reduce the amount of waste produced, 3) Everyone is responsible for reducing the amount of waste produced, 4) The enjoyment of coffee will be enhanced if one knows that coffee grounds are managed properly, 5) Coffee grounds contain materials that are still useful, and 6) The use of coffee grounds will have a positive impact on reducing environmental impact.

Behavioral intention in environmental awareness reflects a person's alignment to take action based on concern for the environment. Behavioral intention differs from actual behavior, which refers to actions that have already been taken and is typically measured in terms of frequency, such as never to always. Statements regarding behavioral intention consist of five indicators: 1) Coffee grounds can be viewed as non-waste, 2) reusing coffee grounds is a waste reduction measure, 3) maintaining the quality of coffee grounds involves separating them from other waste, 4) efforts to reuse coffee grounds will have a positive impact on coffee shop businesses, 5) coffee grounds can inspire creative business ideas. Actual behavior is measured by the management of coffee grounds waste carried out by coffee shops. Coffee grounds waste management starts with the simplest step: sorting waste types. Coffee shops that have implemented waste sorting are scored 1, while those that have not are scored 0.

The variable structure follows the Theory of Reasoned Action model (Fishbein & Ajzen, 2010) and previous studies, namely that knowledge and awareness influence attitude, which leads to behavioral intention and subsequently influences actual behavior. The conceptual framework is illustrated in Figure 1 and the hypotheses are as follows:

H1: Awareness of coffee grounds waste has a positive influence on attitudes toward coffee grounds waste
H2: Knowledge about coffee grounds waste has a positive influence on attitudes toward coffee grounds waste
H3: Attitudes toward coffee grounds waste have a positive influence on the intention to engage in environmentally friendly behavior.
H4: The intention to engage in environmentally friendly behavior has a positive influence on actual behavior.

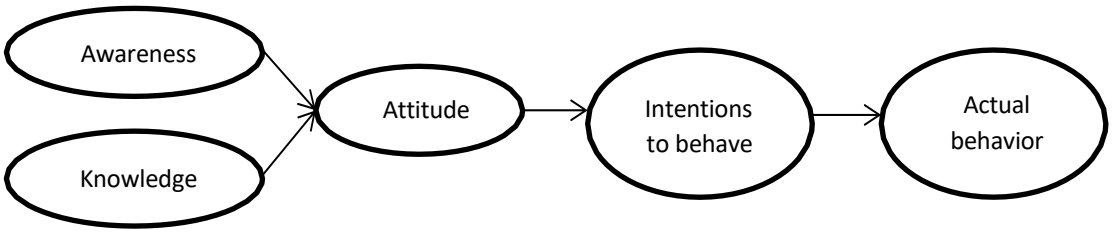

Fig. 1. Conceptual framework

2.3 Data analysis

Interview responses were recorded and collected using Microsoft Excel. A total of 200 respondents were obtained after cleaning the data that was deemed unsuitable. The data was then converted into numerical form to enable analysis. Each variable's total score was calculated and then transformed into an index value. The index value was used to obtain ratio data and to enable comparisons between variables. The index value was calculated by subtracting the minimum score a respondent could obtain from the total score obtained by the respondent, then dividing this by the difference between the maximum score obtainable and the minimum score obtainable, and finally multiplying by 100. After obtaining the index

values, the average was calculated. Data was categorized as "good" if it obtained a value above the average of each variable and categorized as "poor" if it was below the average (Ridwan et al., 2023). The partial least squares test was conducted using SmartPLS software to determine the direct and indirect effects of each variable. PLS analysis is suitable for exploratory models with a large number of latent constructs and complex indicators with a moderate sample size of around 200 samples.

The PLS testing stages conducted include the outer model test to examine outer loading values, reliability estimates, and validity; the goodness-of-fit test to assess model suitability; and the inner model test to determine the magnitude of significant variable effects (Muhson, 2022). In the outer model test, indicators with outer loading values that do not meet the criteria are eliminated. The reliability of variables is assessed using composite reliability or Cronbach's alpha, while validity is assessed using average variance extracted. The goodness-of-fit test is conducted by examining the criteria of a standardized root mean square below 0.08 or a root mean square below 0.12 (Hair et al., 2017). The inner model test conducted in this study used bootstrapping analysis. A variable is considered significantly influential if it obtains a T- value greater than 1.96 (Muhson, 2022).

3. Results and Discussion

3.1 Demographic characteristics

The demographic characteristics of the respondents are summarized in Table 1. All respondents are coffee shop business owners or employees. All fall within the productive age category according to the Central Statistics Agency/*Badan Pusat Statistik* (BPS), which is 15–64 years old. The largest proportion (68.5%) of respondents are in the late teenage to young adult age group, i.e., 15–24 years old. Approximately a quarter of the respondents were in the middle-aged group, and the remainder were in the older adult group. Approximately three-quarters of the respondents were high school graduates, and 20.5% had pursued education up to the bachelor's degree or diploma level. 2.5% of the respondents were junior high school graduates, and there was one respondent who had only completed elementary school education. Nearly half of the business premises (45.5%) are privately owned, about half (51.0%) are rented or leased, and the remaining 6% are unsure of the ownership status of the premises. More than half (57%) of the coffee shops have been in operation for less than a year. Another third have been in operation for one to less than three years. The remaining 9.5% have been operating their coffee shops for three years or more. Most respondents (70%) earn an average daily income of less than one and a half million rupiah, and nearly a quarter (24.0%) earn between one and a half million and three million rupiah. The remaining 6% earn an average daily income of more than five million rupiah

Table 1. Demographic characteristics of respondents (N=200)

Characteristics	Category	Frequency	Percentage
Age	15–24	137	68.5
	25-39 years	52	25.5
	>40 years old	12	6.0%
	Total	200	100
Education	Elementary School/Equivalent	1	0.5
	Junior High School/Equivalent	5	2.5
	High School/Equivalent	153	76.5
	Bachelor's Degree/Diploma/Equivalent	41	20.5
	Total	200	100
Ownership status	Private	91	45.5
	Contract/lease	102	51.0
	Don't know	6	3.0
	Total	200	100

Lengt of business	Less than 1 year	114	57
	1 to less than 3 years	67	33.5
	3 years or more	19	9.5
	Total	200	100
Average daily income	<IDR 1,500,000	140	70
	IDR 1,500,000 - IDR 3,000,000	48	24
	>IDR. 5,000,000	12	6.0
	Total	200	100

3.2 Awareness

The awareness variable obtained an average index value of 56.2, as shown in Table 2. Respondents in the good category (63.5%) outnumbered those in the poor category (36.5%). These results indicate that respondents have a fairly good awareness of coffee grounds waste. Respondents are aware that coffee grounds are not merely waste that is no longer used, but can be reused and still have economic value. In addition to economic benefits, the reuse of coffee grounds can have a positive impact on the environment by reducing water pollution.

Table 2. Distribution of respondents based on awareness category variables

Awareness category	Frequency	Percentage
Poor	7	36.5
Good	127	63.5
Total	200	100.0%
Average index value	56.2	

3.3 Knowledge and attitude

The average knowledge index score was higher at 58.0. However, Table 3 shows that the percentage of respondents categorized as poor was higher at 51.5 percent. Respondents categorized as good reached 48.5 percent, slightly different from those categorized as poor. Knowledge involves more complex information compared to awareness. This may explain why there are more respondents categorized as poor than those categorized as good. Some respondents are not yet fully aware of the content, benefits, or proper handling of coffee grounds waste.

Table 3. Distribution of respondents based on knowledge variable categories

Knowledge variable category	Frequency	Percentage
Poor	10	51.5
Good	97	48.5
Total	200	100.00%
Average index value	58.0	

Table 4 shows that the average attitude index score reached 59.9. This average score is the highest compared to other variables. The percentage of respondents categorized as good reached 62.5 percent, which is significantly higher than those categorized as bad. This percentage is higher than the worst and higher when compared to other variables. This indicates that respondents already have a positive attitude toward coffee grounds waste. Respondents believe that coffee grounds can be reused and will have a positive impact on the environment. The positive impacts on the environment include reducing the amount of waste generated and fostering the habit of sorting waste, starting with the separation of coffee grounds waste.

Table 4. Distribution of respondents based on attitude variable categories

Attitude variable category	Frequency	Percentage
Poor	75	37
Good	125	62.5

Total	200	100.00%
Average index value	59.9	

3.4 Behavioral intensity and actual behaviord

Behavioral intention obtained an average index value of 56.6. The percentage difference between respondents categorized as good reached 58.0 percent. This finding indicates that the percentage of respondents categorized as good is higher compared to the percentage of respondents categorized as poor, as shown in Table 5. This suggests that a significant number of respondents have the intention to treat coffee grounds waste not as waste but as a commodity beneficial to both the environment and the economy.

Table 5. Distribution of respondents based on the category of behavioral intention variables

Category of behavioral intention variable	Frequency	Percentage
Poor	8	42
Good	116	58.0
Total	200	100.00%
Average index value	56.6	

Actual behavior in this study is represented by the habit of sorting waste that has been carried out by respondents as coffee shop business operators. The interview results show that only 30 percent of respondents sort waste at their coffee shops. The remaining 70 percent still mix the waste produced by their coffee shops. The waste sorting practices of coffee shop business owners also vary. Some respondents sort between food waste, kitchen waste, plastic packaging, coffee grounds, and other waste. Most waste sorting is only done for coffee grounds. The sorted waste is then handed over to a third party for management and is not processed by the coffee shop itself.

3.5 Partial least squares test

The partial least squares test begins with developing a test model following the conceptual framework. Actual behavioral variables are measured using a single indicator, namely whether coffee shops have implemented waste sorting or not. Outer model testing using the PLS algorithm aims to evaluate the validity of indicators against latent constructs measured through outer loading value analysis. An indicator is considered to have adequate convergent validity if its outer loading value exceeds the threshold of 0.70. However, in the evaluation process, there are indicator elimination criteria that need to be considered. Indicators with outer loading values below 0.40 are directly eliminated because their contribution to theconstruct is too low. Meanwhile, indicators with outer loading values in the range of 0.40 to 0.70 are considered for elimination if their removal is proven to improve the composite reliability (CR) or average variance extracted (AVE) s (Hair et al., 2017). This approach is taken to ensure that the measurement instrument has optimal reliability and convergent validity. Indicators with outer loadings below 0.4 that were immediately eliminated include the first indicator of the awareness variable and the second indicator of the knowledge variable. Indicators with values between 0.40 and 0.70 that, when eliminated, improved CR and AVE values include the fifth indicator of the awareness variable and the third and fourth indicators of the attitude variable.

Table 6. Results of reliability and construct validity tests

Variable	AVE	Composite reliability	Cronbach's alpha
Awareness	0.559	0.909	0.885
Knowledge	0.511	0.860	0.802
Attitude	0.554	0.831	0.730
Behavioral Intensity	0.514	0.837	0.759
Actual behavior	1	1	1

The results of the reliability and validity tests are listed in Table 6. Reliability is assessed based on composite reliability and Cronbach's alpha, while validity is assessed based on the average variance extracted. All Cronbach's alpha values meet the criteria, with values above 0.70. A higher CR value indicates better reliability. Acceptable CR values fall within the range of 0.70 and 0.90 because values far exceeding 0.90 indicate that all indicator variables measure the same phenomenon and therefore cannot be valid measures of the construct. (Hair et al., 2017). The CR value in this study meets the criteria, indicating good reliability. The minimum AVE value reaches 0.50, indicating that, on average, the construct explains more than half of the variance in its indicators. (Hair et al., 2017). The AVE value in this study exceeds 0.5, indicating good construct validity.

Model fit testing was conducted by examining the standardized root mean square residual (SRMR) and root mean square residual covariance (RMStheta)values. The RMS(theta)value in this study was 0.162, exceeding the maximum criterion of 0.12. The SRMR value was 0.091, which did not meet the ideal criterion of below 0.08. However, it met the model feasibility criterion of below 0.10, which is still acceptable (Muhson, 2022). This means the model can be considered fit.

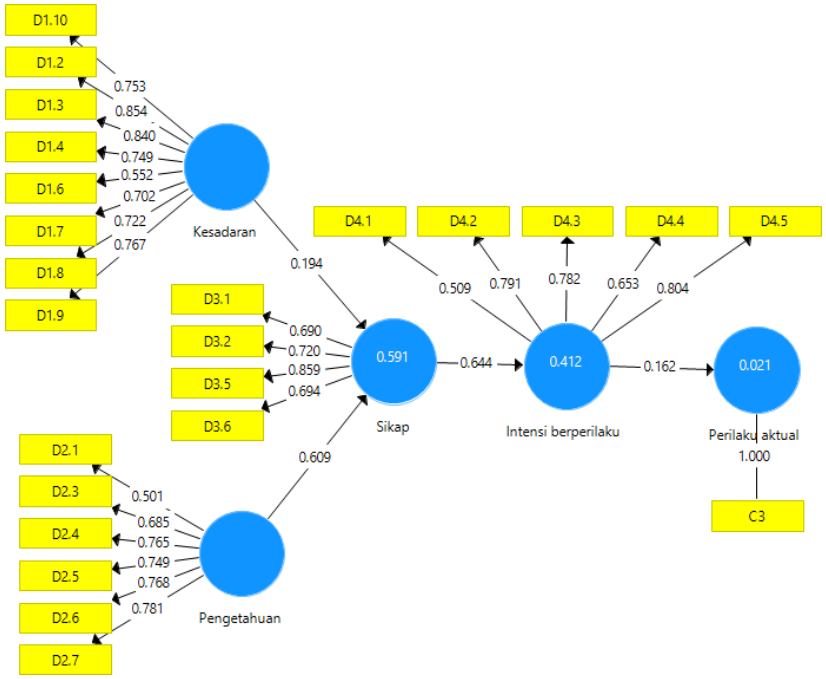

Fig. 2. Final PLS test model

The results of the direct and indirect influence analysis are summarized in Table 7. The awareness variable does not have a significant influence on any variable, either directly or indirectly. Unlike the awareness variable, knowledge significantly influences attitude, behavioral intention, and actual behavior. Knowledge influences attitude with a β value of 0.626, indicating that an individual's knowledge about the benefits of coffee grounds has a significant impact on how they perceive coffee grounds. Knowledge also has an indirect impact on behavioral intention (β = 0.435) and actual behavior (β = 0.070). This means that an individual may behave and have the intention to engage in environmentally friendly behavior because they are indirectly influenced by the knowledge they possess. The analysis results also show that attitudes toward coffee grounds have a significant influence on an individual's behavioral intentions toward coffee grounds with a value of β=0.694. This indicates that attitude is one of the major factors in determining a person's desire to do something. This attitude also predicts actual behavior due to an indirect influence of β=0.112. A person's intention to reuse coffee grounds significantly influences their behavior, as demonstrated by waste sorting behavior. Behavioral intention significantly influences actual behavior with a value of β=0.162. The results of the PLS analysis indicate

that among the five variables, only the awareness variable does not have a significant effect, either directly or indirectly. Knowledge, attitude, behavioral intention, and actual behavior have a direct effect on the subsequent variables in sequence. Indirect effects also occur from knowledge to behavioral intention and actual behavior, as well as from attitude to actual behavior. Knowledge has a significant influence on attitude, indicating that knowledge is an important factor in determining attitude.

Table 7. Results of effect decomposition in the direct and indirect influence model

Variable	Total effect	P values	T values
Awareness→Attitude	0.184	0.060	1.88
Knowledge→Attitude	0.626	0	6.86
Attitude→Behavioral intention	0.694*	0	12.94
Behavioral intention→Actual behavior	0.162	0.009	2
Awareness → Attitude → Behavioral intention	0.129	0.072	1.80
Knowledge → Attitude → Behavioral Intention	0.435	0	5.75
Attitude → Behavioral Intention → Actual Behavior	0.112	0.013	2
Awareness → Attitude → Behavioral intention → Actual behavior	0	0.167	1.38
Knowledge → Attitude → Behavioral Intention → Actual Behavior	0	0	2.26

* Significant at p<0.05 or t>1.96

This result aligns with Mago et al. (2024), which revealed that environmental knowledge significantly influences pro-environmental behavior, with environmental attitude and environmental sensitivity acting as significant mediators in that relationship. Unfortunately, more than half of coffee shop operators have poor knowledge about coffee waste management. Knowledge not only plays a major role in determining attitudes but also indirectly influences behavioral intentions and actual behavior. This indicates there is still significant potential for improvement to encourage environmentally friendly behavior and the reuse of coffee grounds waste. Therefore, to enhance environmentally conscious behavior, one of the initial steps that needs to be taken is to improve environmental knowledge. Environmental education has proven effective in enhancing environmental knowledge, which in turn fosters attitudes, intentions, and environmentally conscious behavior (Wetering et al., 2022). It is also important to note that the knowledge an individual possesses can actually hinder positive attitudes toward the environment if not accompanied by prosocial values (Tamar et al., 2021).

Contrary to knowledge, awareness does not have a significant influence on a person's attitude, intentions, and behavior regarding coffee grounds. Although more than half of coffee shop business owners are categorized as having good awareness, statistics reveal that awareness has not been able to bring about significant changes in attitude. This finding contradicts the study by Agrawal et al. (2023), which identified a positive influence of environmental awareness on environmentally friendly practices and its role as a mediator in the relationship between social media influence and environmentally friendly behavior. The difference in results is likely due to differences in respondent characteristics and the measurement of environmentally friendly behavior. The study focused on environmentally friendly practices at the individual level, such as the tendency to choose environmentally friendly products among Generation Z. Nevertheless, the results of this study align with the research by Debrah, Vidal, & Dinis (2021), which revealed that in developing countries, high environmental awareness or positive attitudes toward the environment do not impact environmental participation, particularly regarding waste management, due to the lack of practice-based education. This is likely because awareness remains at an initial stage and has not yet involved deeper understanding. Additionally, the average score for the awareness index tends to be lower than that for knowledge. This indicates that the level of awareness among coffee shop managers is still relatively low. Unlike awareness, individuals with higher knowledge levels are not only concerned about the environment but also more

actively involved in supporting and promoting environmental protection efforts (Debrah et al., 2021). Awareness and influence each have different impacts on an individual's behavior.

Environmental awareness influences the intention to behave environmentally friendly through their habits, while knowledge influences the attitudes that are formed, which in turn influence an individual's intention to behave environmentally friendly (Tavitiyaman et al., 2024). Knowledge and attitudes toward the environment play a crucial role in shaping environmentally friendly behavior in public or collective spaces, with professional practitioners showing a stronger relationship between knowledge and pro-environmental behavior compared to students, in line with the depth of understanding gained through industry experience (Burgos-Espinoza et al., 2024). Environmental awareness that can influence an individual's behavior requires a deeper dimension. Zhang et al. (2024) reveal that the dimensions of environmental awareness influencing behavior are a sense of environmental responsibility, concern for the environment, and an individual's ability to behave in an environmentally friendly manner.

Research findings highlight the importance of attitudes in the process influencing an individual's behavioral intentions. Positive attitudes are formed due to a sense of environmental responsibility, which motivates an individual's intention to behave by considering environmental aspects (Biswas et al., 2020). This is also evidenced by attitudes that indirectly impact an individual's actual behavior. However, there is a significant difference between the influence on attitudes and the influence on actual behavior. Wut, Lee, & Lee (2023) explain that there is a gap between attitudes and behavior mediated by moderator factors such as perceived benefits, perceived risks, effects on others, economic factors, and ease. In line with the interview results, some reasons cited by coffee shop operators regarding their waste management practices include following local customs, choosing easier methods, and disposing of waste directly out of fear of inconveniencing customers. Additionally, one in three respondents believed that waste management was in line with their preferences. This indicates that coffee shop operators are already sufficiently satisfied with their current waste management practices, even though only a third of them engage in waste sorting.

Actual behavior is significantly influenced by behavioral intentions. This confirms that behavioral intentions play a role in changes in actual behavior. The extent to which intentions influence actual behavior, namely waste sorting, is statistically insignificant. This may be due to a lack of indicators for measuring actual behavior, which is only observed in the act of sorting waste. This is compounded by the low rate of waste sorting in coffee shops, which is less than a third. At the industry level, factors hindering environmentally friendly behavior include concerns about additional costs, insufficiently supportive regulations, lack of alignment with social norms, and insufficient knowledge and information (Dioba et al., 2024).

Coffee shop operators report that waste from coffee shops is generally processed in accordance with local government policies. Most coffee shop waste is transported by third parties, who then handle its processing. Some coffee shop operators find it easier to delegate waste processing to third parties. The perceived difficulty of changing lifestyles acts as a psychological barrier due to the lack of systems and infrastructure that facilitate individuals in making lifestyle changes toward more environmentally friendly practices (Bosone et al., 2022). If third parties mix the waste they collect, coffee shop operators feel that waste sorting is unnecessary.

Environmentally friendly behavior such as reusing coffee grounds still seems to require a long process. Few coffee shop businesses are taking initial steps such as sorting waste. Even coffee shop businesses that have started sorting waste hand over further management to third parties, and some choose to burn the waste. To encourage environmentally friendly behavior, interventions are needed to address both internal and external factors. Linder et al. (2021) state that intention is the strongest internal factor in eliciting new behavior outside of routine habits. The results of this study indicate that the knowledge of coffee shop business owners has a significant impact on their intention to behave and also on their behavior in sorting waste. Increasing education about the environment and training in

coffee grounds management can be a way to enhance the knowledge of coffee shop business owners, thereby encouraging proper waste sorting and management behavior. These results align with the study by Herdiansyah & Nuraeni (2024), which emphasizes the importance of environmental education on waste management, as good knowledge fosters attitudes toward environmentally friendly behavior. Meanwhile, for external factors, both the physical and social environments require attention. One common reason individuals are reluctant to sort waste is that Indonesia's waste collection system still mixes all types of waste. The physical environment, such as the layout of waste bins, interacts with intentions and significantly impacts recycling behavior (Linder et al., 2021). This highlights the need for facilities, systems, and infrastructure that facilitate coffee shop operators in conducting waste sorting and reusing coffee grounds. Interaction with the social environment and conformity also contribute to environmentally friendly behavior (Zhu et al., 2021). If environmentally friendly behavior becomes a policy and habit within the coffee shop environment, it will increase the likelihood of coffee shop operators participating in waste sorting and reusing coffee grounds.

The findings of this study are consistent with and contribute to the strengthening of the Theory of Reasoned Action (Fishbein & Ajzen, 2010), particularly in terms of knowledge, which plays a significant role as a determinant of behavior through attitudes and intentions. The findings also indicate a low influence of intention on actual behavior, suggesting the existence of an intention-behavior gap, i.e., the mismatch between intention and actual action. This gap is believed to be influenced by actual control factors such as individual ability, competencies possessed, and external conditions such as the physical and social external environment. Although the original TRA model did not include control factors, its development in the Reasoned Action Approach (Fishbein & Ajzen, 2010) added the component of perceived behavioral control as a way to represent the extent to which individuals feel capable of performing a particular behavior. Therefore, these findings highlight the importance of considering control factors in explaining behavior and open opportunities for future research to include such variables to enhance the accuracy of behavioral predictions.

4. Conclusions

This study successfully highlights the readiness of coffee shop operators to adopt environmentally friendly behaviors while identifying strategies that can be implemented to enhance this readiness and encourage behavioral changes toward greater sustainability. Knowledge has been shown to foster more positive attitudes toward the environment and increase individuals' intentions to sort and reuse coffee grounds, which is reflected in their behavior. This study contributes to the literature on environmental behavior by highlighting the different roles of environmental awareness and knowledge. These findings underscore the urgency of implementing environmental education for business operators, particularly regarding the ecological impact of coffee waste. Additionally, providing entrepreneurship education that highlights the economic potential of waste management could potentially attract business operators to actively engage in recycling practices.

This study also found a tendency among coffee shop business actors to outsource waste management to third parties. This finding indicates a strategic opportunity for developing a collaborative waste management system that requires service providers to sort waste from the source. Sorting by producers will enhance the utility value of waste while simplifying the processing into recycled products. Therefore, the government's role is crucial in formulating policies and providing infrastructure that supports recycling practices in the industrial sector. Waste sorting and processing should be an integral part of the national waste management system.

However, this study is not without limitations. Actual behavioral variables in this study were measured using only one indicator, namely waste sorting. This caused a gap with other variables that discussed coffee grounds utilization in greater detail. In addition, the actual behavior indicator had a dichotomous response scale that did not provide sufficient

variation or insight. Behavior is measured by whether or not it is performed, so it is not possible to obtain an understanding of the frequency or intensity of the behavior. The knowledge variable measures respondents' perceptions of the information they know, without assessing the truth or accuracy of the information known by the respondents. Finally, this study did not conduct testing using respondents' demographic characteristics. Further research is recommended to develop indicators and response scales that better describe respondents' actual behavior. Testing and analysis using demographic characteristics can be conducted in future studies to enhance understanding of variations in behavior or attitudes. Future research could utilize other theories to gain new perspectives, such as the Theory of Planned Behavior, which considers external factors in behavior adoption. Other variables influencing behavioral intent based on the Theory of Reasoned Action, such as norms and beliefs, could be interesting areas for further investigation.

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