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Antecedents of Energy-saving Behaviors in Thailand: A Study in Samut Sakhon Province

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Abstract

This research aims to examine the level of energy-saving behaviors of Thai adults and investigate the impact of demographic (age, gender, education, and income) and psychological (environmental concern and environmental beliefs) factors on energy-saving behaviors. The research uses Stata software to conduct a quantitative analysis on a secondary dataset collected from Samut Sakhon province. This study analyzed the proposed models using structural equation modeling (SEM). The results were as follows: 1) The respondents often performed energy-saving behaviors, firmly believed in the importance of nature, and were moderately concerned about the environment; 2) Environmental concerns and beliefs have direct and positive impacts on energy-saving behaviors; 3) Environmental concerns and beliefs mediate the effects of demographic factors on energy-saving behaviors. This study provides implications for marketing practitioners and policymakers in creating effective strategies to encourage specific market segments to perform energy-saving behaviors.

Keywords: Energy-saving behaviors, Environmental belief, Environmental concern

Introduction

Marketers acknowledged that ecologically conscious consumers are crucial to alleviating environmental problems and creating sustainability (White et al., 2019). Researchers attempt to develop the profiles of ecologically conscious consumers based on the factors influencing their behaviors to effectively persuade consumers with strategies and tactics customized to their profiles. Prior research reported that consumers' sustainable behaviors were affected by demographic factors, such as age, income, and gender (Gifford & Nilsson, 2014; Scott & Willits, 1994; Schultz et al., 1995), and psychological factors, such as consumer attitudes toward the natural environment (Steg et al., 2014).

Although many studies examined the impacts of demographics and psychographic factors on sustainable behaviors, studies examining both factors in the Thai context are somewhat limited. Consequently, we would like to investigate the

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impact of demographic and psychological factors on sustainable behaviors in the Thai context. The sustainable behaviors focused on in this study are energy-saving behaviors. Energy saving policy has been one of the significant environmental policies implemented by the Thai government. The government regularly revises its national energy policies and enforces them through all government agencies. As recently as 2022, the Thai government updated its policy and required all government agencies to comply with several energy-saving measures (Energy Policy and Planning Offices, 2022). As a result, Thai citizens have become widely aware of the energy-saving behaviors promoted by these policies.

Thai people also receive significant information regarding energy-saving activities from the Electricity Generating Authority of Thailand (EGAT), the public enterprise generating and supplying electricity to Thai households. Following the national energy-saving policy measures, EGAT provides specific guidelines for Thai households. EGAT recommends that households perform behaviors such as turning off the light when there is enough light in the room, unplugging electronic appliances when not in use, and using energy-saving light bulbs and appliances (EGAT's website, 2024).

This study aims to explore the energy-saving behaviors of Thai adults and identify the factors affecting those behaviors. We hope this investigation sheds light on how Thai adults engage in energy-saving behaviors and how those behaviors are influenced by the adults' demographic and psychological factors. The findings from this study should contribute both theoretically and practically. Theoretically, they should provide empirical evidence highlighting factors influencing individuals' engagement with energy-saving behaviors. Practically, the findings should help marketers design customized marketing strategies or campaigns appropriate for each market segment to encourage them to engage more in energy-saving behaviors.

Research Objectives

1. To examine the levels of energy-saving behaviors of adults in Thailand.
2. To investigate the impacts of environmental attitudes (environmental concerns and beliefs) on energy-saving behaviors.
3. To investigate the impacts of demographic factors (age, gender, education level, and income) on energy-saving behaviors.
4. To explore the relationships between demographic and psychological factors when affecting energy-saving behaviors.

Hypothesis

1. Age has an impact on energy-saving behaviors. Younger people engage more in energy-saving behaviors than older people.

2. Income has a positive impact on energy-saving behaviors. People with higher incomes engage in energy-saving behaviors more often than people with lower incomes.

3. Gender has an impact on energy-saving behaviors. Females engage more in energy-saving behaviors than males.

4. Education has an impact on energy-saving behaviors. People with higher education engage in energy-saving behaviors than people with lower education.

5. Environmental concern has a positive impact on energy-saving behaviors.

6. Environmental belief has a positive impact on energy-saving behaviors.

Conceptual Framework

The figures 1, 2, and 3 below illustrate the relationships between the variables in our conceptual models. The first models test the direct impact of demographic factors (age, gender, income, and wealth) on energy-saving behaviors. The second model simultaneously tests the direct impacts of demographic and psychological factors (environmental concerns and beliefs) on energy-saving behaviors. The third model tests the direct and indirect impacts of demographic factors, where environmental concerns and beliefs mediate the impacts of demographic factors.

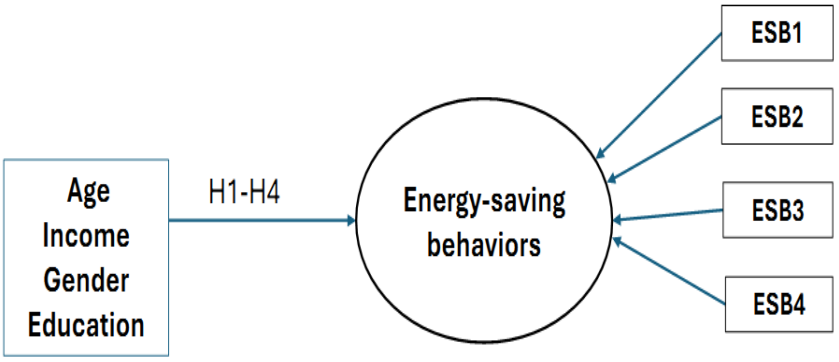

Figure 1: Conceptual Framework of Model 1

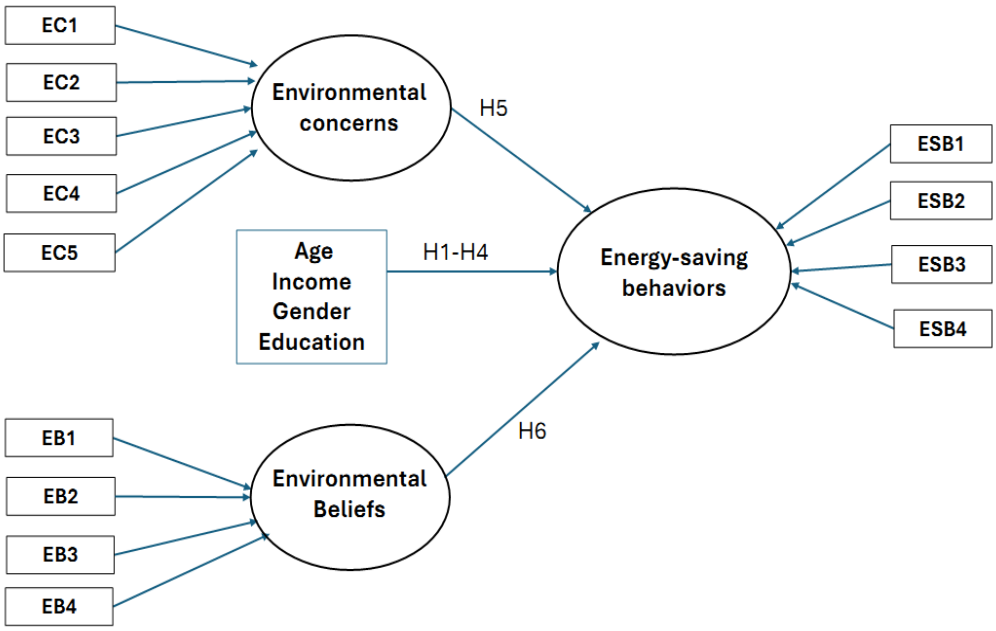

Figure 2: Conceptual Framework of Model 2

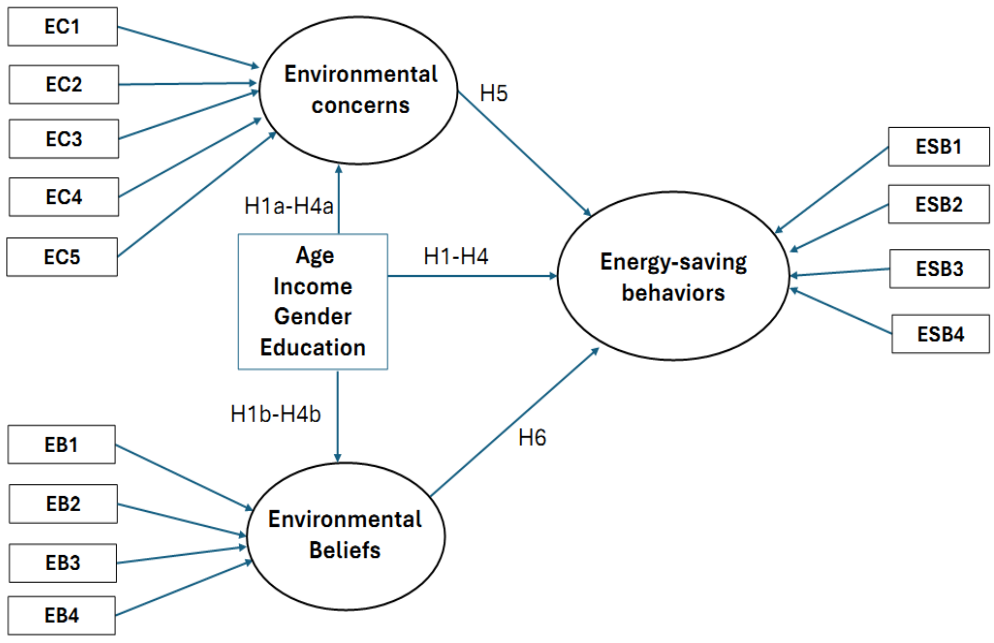

Figure 3: Conceptual Framework of Model 3

Literature Review

Energy-Saving Behaviors as A Dimension of Pro-Environmental Behaviors

This study focuses on energy-saving behaviors, which are pro-environmental behaviors familiar to Thai consumers. Based on prior literature, energy-saving behaviors can be categorized as good citizenship behaviors by Lee et al. (2014) and sustainable

consumer behaviors by White et al. (2019). Lee et al. (2014) defined pro-environmental behavior as the behavior that has a positive impact on the availability of materials or energy and behavior that positively alters the structure and dynamics of ecosystems or the biosphere (Lee et al., 2014, p.2098). The researchers categorized pro-environmental behaviors into three categories: green purchase behavior, good citizenship behavior, and environmental activist behavior. From the consumer's perspective, researchers define sustainable consumer behaviors as "actions that result in decreases in adverse environmental impacts as well as decreased utilization of natural resources across the lifecycles of the product, behavior, or service (White et al., 2019 p.24)." The researchers stated that sustainable consumer behaviors include voluntarily reducing one's consumption, choosing products with sustainable sourcing, and conserving resources while using the products.

Demographic Factors' Impact on Pro-environmental Behaviors

Age: Prior research findings suggest that younger consumers were more concerned about the environment than older people. Scott and Willits (1994) reported that younger consumers have a more favorable attitude toward the relationship between humans and the environment. In a study of a Chinese sample, Chen et al. (2011) also found that younger consumers were more likely to participate in pro-environmental activities. Abeliotis et al. (2010) reported an influence of age on Greek consumers' engagement with reduce, reuse and recycle activities. A study by Mertig and Dunlap (2001) found that younger respondents showed stronger support for environmentalism than older respondents.

Income: Researchers speculate a positive relationship between income and environmental attitudes and behaviors. Scott and Willits (1994) found that income positively relates to pro-environmental attitudes and environmental behaviors. Abeliostis et al. (2010) reported a significant positive effect of income on consumers' engagement with sustainable consumption in Greek consumers. Reviewing studies examining the impacts of demographic variables on recycling behavior, Schultz et al. (1995) identified a positive correlation between income and recycling behavior. The researchers suggested that people with higher income levels were more likely to recycle than people with lower income levels.

Gender: Prior literature reported gender differences in environmental attitudes and behaviors. Researchers found that women were more likely to have higher environmental attitudes and concerns than men (Gifford & Nilsson, 2014). Prior studies also found that women engaged more in environmentally friendly behaviors than men (Casaló et al., 2019; Olli et al., 2001). Chen et al. (2011) also reported that female respondents were more likely to sort and recycle garbage than their male counterparts.

A study by Mertig and Dunlap (2001) reported that female respondents showed stronger support for environmentalism than male respondents. In a study of children's pro-environmental behaviors, Pointon (2014) reported that girls expressed more concern about and a need to care for nature than boys.

Education: Researchers expected highly educated consumers to behave more favorably towards the environment because the consumers obtained knowledge about environmental issues through schooling (Patel et al. (2017). Scott and Willits (1994) reported positive correlations between education, environmental attitudes, and pro-environmental behaviors. Patel et al. (2017) found that highly educated individuals engaged more in pro-environmental behaviors. Sánchez et al. (2016) reported that education positively affected the respondents' pro-environmental consumption. Chen et al. (2011) also found that individuals with higher education engaged more with pro-environmental behavior.

Environmental Attitude's Impact on Pro-environmental Behaviors

The impact of environmental attitude has been widely studied. Researchers reported that environmental attitude could influence pro-environmental behavior, such as green purchasing behavior and socially responsible purchases. This study will examine two dimensions of environmental attitude: environmental concern (biospheric concerns) and environmental belief (environmental affection).

Environmental concern: Schultz (2000) measured environmental concerns by three dimensions, including biospheric, altruistic, and egoistic. The researcher defined biospheric concerns as the concerns for all living things (plants, marine life, birds, animals). Prior studies have acknowledged the positive impact of environmental concerns on pro-environmental behaviors. Schultz (2000) suggested that biospheric concerns are more likely to affect environmentally responsible behavior. Similarly, Steg et al. (2014) speculated that individuals with strong biospheric concerns are more likely to engage in pro-environmental behavior. Lee et al. (2014) found that environmental concern positively impacts good citizenship and green purchase behaviors. In the context of pro-environmental behaviors in young children, Evans et al. (2007) reported that the children had moderately high environmental concerns and were likely to behave sustainably.

Environmental beliefs: Prior research widely used the New Environmental Paradigm (NEP) to assess individuals' environmental worldviews. Dunlap (2008) stated that using NEP to measure environmental beliefs is the most accurate interpretation of the scale. Findings from prior research suggested a positive relationship between environmental beliefs and pro-environmental behaviors. Olli et al. (2001) found that environmental beliefs positively correlated to pro-environmental behaviors, such as waste handling,

resource conservation, and responsible consumption. Mayer and Frantz (2004) found positive correlations between environmental beliefs and pro-environmental behaviors. In the context of young consumers, Kaiser et al. (1999) found that environmental beliefs, measured by the right-to-nature dimension of the NEP scales, could predict children's pro-environmental behaviors in Germany.

Moderating roles of psychological factors and indirect impacts of demographic factors on energy-saving behaviors

In a review by Gifford and Nilsson (2014), the researchers acknowledged that environmental outcomes could be determined by combinations of several factors. The researchers suggested that scholars should investigate these factors' moderating and mediating roles towards one another when examining their impacts on pro-environmental behaviors. Accordingly, this study aims to test three conceptual models, as shown in Figures 1, 2, and 3. In the third model, environmental concerns and beliefs are hypothesized to mediate the impacts of demographic factors.

Methodology

1. Research Method

This research conducts a quantitative analysis on a secondary dataset to test the hypotheses. First, this study performs a descriptive analysis to explore the mean, standard deviation, and correlations between the variables in the models. Then, structural equation modeling is conducted to test the proposed models. This study conducts statistical analyses using Stata software.

2. Population and Sample

This paper utilizes secondary data from a survey by the Research Institute of Policy Evaluation and Development (RIPED) at the University of the Thai Chamber of Commerce (UTCC). The survey team collected the data in February 2023 in Samut Sakhon, a province fifty kilometers west of Bangkok. UTCC granted RIPED ethical approval for data collection. The dataset comprises a sample of 2,920 parents /caretakers of students (grades three, six, and nine) who participated in a survey investigating the impact of the COVID-19 pandemic on their learning outcomes. The dataset was collected from fifty-eight (out of sixty) schools that agreed to participate in the survey. The survey team by RIPED asked the students to bring the questionnaires back home to their parents/caretakers to complete. It is important to note that the current study utilizes only the parents/caretakers' questionnaire data.

3. Research Instrument

Energy-saving behaviors are measured by four items adopted from Heyl et al. (2013), Kaiser et al. (2007), and Singh et al. (2020), with a Cronbach alpha of 0.67.

The respondents were asked how frequently they perform the following activities, including i) turning off the lights when leaving a room or when there is enough natural light, ii) switching off electronic appliances when not in use, iii) using energy-saving light bulbs, and iv) looking for energy-saving labels before buying electronics. Their answers were recorded on a three-point Likert scale, ranging from '*never'* to '*always'*.

Environmental concerns are measured by five items adapted from Evans et al. (2007), with a Cronbach alpha of 0.88. The respondents were asked how much they were worried about i) air pollution, ii) water pollution, iii) inadequate resources for the world population, iv) the amount of waste humans generate, and v) shrinking forests or community green space. Their answers were recorded on a five-point Likert scale, ranging from '*not worried*' to '*very worried.'*

Environmental beliefs are measured by four items adapted from Kaiser et al. (1999) and Manoli et al. (2007), with a Cronbach alpha of 0.75. The respondents were asked if they agree that i) all organisms' lives are precious and worth preserving, ii) the earth's value does not depend on people but is valuable in itself, iii) all things, whether human, animals, plants, have the right to exist, and iv) nature is fragile and can be easily destroyed. Their answers were recorded on a five-point Likert scale, ranging from *'strongly disagree'* to '*strongly agree.'*

All measurement items for energy-saving behaviors, environmental concerns, and environmental beliefs were factor-analyzed using principal component analysis with orthogonal varimax rotation (Results are available upon request). The items loaded on the factors that they intended to measure. Most item loadings were above the threshold of 0.70, except for a few. The three factors explained 60.6 % of the variance of the sample data.

Age is represented by a continuous variable using actual age. Education level is represented by a dichotomous variable, with zero indicating that the education level is lower than the college level and one indicating that the education level is equal to or higher than the college level. Gender is represented by a dichotomous variable, with zero representing male and one representing female. Since the data set utilized in this study does not contain income data, we use the wealth index to measure the wealth of the individuals instead of income data. The higher the number, the wealthier that individual is.

4. Data Analysis

This study conducts statistical analyses using Stata software. Table 1 shows the descriptive statistics of the sample. Among the sample, 73.2 % were female, and the average age was 43.1 years (SD= 10.04, ranging from 18 to 85 years). Most of the sample are high school graduates or those with a lower level of education (73 %), with about

13% having a college degree or higher. The average value of the wealth index is 0.03 (SD = 1.06, ranging from -1.75 to 8.67). Around forty percent of the respondents have a wealth index that is above average.

Table 1: Descriptive statistics of the sample

Item	Detail	Frequency	Percentage
Gender	Male	777	26.79
	female	2,123	73.21
Age	18-29 years	148	5.07
	30-39 years	942	32.26
	40-49 years	1057	36.2
	50-59 years	424	14.52
	>60 years	349	11.95
Education	High School or below	2,127	73.79
	Junior college	369	12.86
	University	317	11.05
	Master or above	66	2.3
Wealth index	Below average	1,436	59.51
	Above average	977	40.49

Results

1. Table 2 shows summary statistics of the measurement items for the three latent variables. The results show the respondents' engagement with energy-saving behaviors and their environmental concerns and beliefs. Respondents often performed energy-saving behaviors (mean = 2.65), firmly believed in the importance of nature (mean = 4.07), and were moderately concerned about the environment (mean = 2.98).

Table 2. Summary statistics of the measurement items

Item	Mean	Std.	Min	Max
ESB: How often do you perform the following activity?	2.65	0.39		
ESB1: I turn off the lights when I leave a room or there is enough natural light.	2.7	0.49	1	3
ESB2: I switch off electronic appliances when not in use.	2.75	0.48	1	3
ESB3: I use energy-saving light bulbs.	2.57	0.6	1	3
ESB4: I look for energy-saving labels before buying electronics.	2.58	0.61	1	3
EC: I am concerned about the following issue.	2.98	0.96		
EC1: Air pollution	2.95	1.13	1	5
EC2: Water pollution	2.87	1.19	1	5
EC3: Inadequate resources for the world population	2.86	1.17	1	5
EC4: Amount of waste humans generate	3.07	1.17	1	5
EC5: Shrinking forests or community greenspace	3.12	1.18	1	5
EB: I agree with the following sentence.	4.07	0.62		
EB1: All organisms' lives are precious and worth preserving.	4.19	0.75	1	5
EB2: The earth's value does not depend on people, but it is valuable in itself.	3.76	0.96	1	5
EB3: All things, whether human, animal, or plant, have the right to exist.	4.30	0.72	1	5
EB4: Nature is fragile and can be easily destroyed.	4.07	0.84	1	5

2. The correlation analysis results in Table 3 show that energy-saving behavior correlates positively and significantly with environmental concerns and beliefs (r = 0.25 and 0.29, respectively). The strongest correlation lies between environmental concerns and beliefs (r= 0.39). Results also show that environmental beliefs correlated positively

with education and wealth (r = 0.094 and 0.090, respectively). In this sample, education and wealth correlate significantly and positively (r = 0.226).

Table 3. Correlations between variables in the model

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) ESB	1						
(2) EC	0.25***	1					
(3) EB	0.29***	0.39***	1				
(4) Age	-0.025	-0.015	-0.039	1			
(5) Gender	0.025	-0.008	0.023	-0.115***	1		
(6) Education	0.057**	0.071***	0.094***	-0.040*	0.034	1	
(7) Wealth	0.082***	0.038	0.090***	-0.008	0.026	0.226***	1

*Note: ***=p<0.001, **p<0.01, *=p<0.05*

This study then conducted structural equation modeling to test the proposed hypotheses. Maximum likelihood estimates were used to measure parameters in the proposed models. This study uses the root mean square error of approximation (RMSEA) and the comparative fit index (CFI) to evaluate the model's goodness of fit.

This study tests three structural equation models. Results from all three models are shown in Table 4. All models show a reasonable fit with data with the RMSEA indices lower than 0.08 and the CFIs at approximately 0.9 (Hu & Bentler, 1999).

3. Results from the first model showed that, among four demographic factors, education is the only factor that has a direct effect on energy-saving behavior (coefficient = 0.054, p<0.05).

4. In the second model, when we consider the impacts of demographic and psychological factors simultaneously, the results showed no direct impacts of any demographic factors. The results showed that environmental concerns and beliefs are the only variables directly and significantly affecting energy-saving behaviors (coefficient = 0.059 and 0.122, p<0.001).

5. In the third model, we find that the impact of education is mediated by environmental concerns and beliefs (coefficient = 0.189 and 0.145, p<0.001). That is, people with higher levels of education engage more in energy-saving activities than people with lower levels of education because they have higher concerns for the environment and a stronger belief in the importance of nature.

Table 4: Coefficients from the structural equation models

	Model 1	Model 2	Model 3
Dependent: Energy-saving behaviors			
Age	-0.001	-0.001	-0.001
Wealth	0.013	0.008	0.008
Gender	0.002	0.001	0.001
Education	0.054*	0.036	0.035
EC		0.059***	0.067***
EB		0.122***	0.123***
Dependent: Environmental concerns			
Age			-0.002
Wealth			0.02
Gender			-0.054
Education			0.189***
Dependent: Environmental beliefs			
Age			-0.004**
Wealth			0.042***
Gender			0.015
Education			0.145***
Number of observations	2,252	2,209	2,209
CFI	0.81	0.92	0.89
RMSEA	0.09	0.06	0.07
Chi-square	277.56	873.44	1,261.81
degree of freedom	14	102	103
p > chi2	0	0	0

*Note: ***=p<0.001, **p<0.01, *=p<0.05*

6. The findings in the third model also showed the indirect impacts of age and wealth on energy-saving behaviors. The effects are mediated by environmental beliefs (coefficient = -0.004 and 0.042, respectively). Younger people engage in energy-saving behaviors more than older people, and wealthier people perform more energy-saving

behaviors than less wealthy people because they have a stronger belief in the importance of nature

Discussions and Implications

1. Discussions

This study conducted a descriptive analysis of a secondary dataset collected from Samut Sakhon province and found that the respondents often performed energy-saving behaviors, strongly believed in the importance of nature, and were moderately concerned about the environment. In addition, results from structural equation modeling showed the significant impacts of psychological factors on energy-saving behaviors. Respondents with higher environmental concerns and beliefs engaged more in energy-saving behaviors. The findings are consistent with those of Lee et al. (2014) and Ollie et al. (2001), which demonstrate that environmental concerns and beliefs positively impact pro-environmental behaviors.

The results also showed that environmental concerns and beliefs mediate the effects of some demographic factors on energy-saving behaviors. The findings support the recommendation by Gifford and Nilsson (2014), stating that researchers should consider the variables' mediating and moderating roles when examining their impacts on pro-environmental behaviors. This study found that environmental concerns and beliefs mediate the effects of education on energy-saving behaviors. Respondents with higher education engaged in energy-saving behaviors because they have higher levels of environmental concerns and beliefs. In addition, this study also found that environmental beliefs mediate the effects of wealth and age on energy-saving behaviors. Wealthier and younger respondents engaged more in energy-saving behaviors because they had a stronger belief in the importance of nature. Contrary to the findings from prior studies (Casaló et al., 2019; Olli et al., 2001), this study did not find the impact of gender on energy-saving behaviors.

2. Implications

The above findings provide both theoretical and practical implications. Theoretically, the lack of impacts from some demographic factors implies that demographics are insufficient to develop a profile of sustainable consumers. When examining the antecedents of energy-saving behaviors, researchers may also need to consider the impacts of psychological factors. Moreover, the findings that environmental attitudes positively affect energy-saving behaviors provide empirical evidence supporting the relationship between attitudes and behaviors. Although some prior research has reported that attitude does not always lead to behavior (Carrington

et al., 2014), the findings in the current study imply that the relationship between attitude and behaviors could be context-specific.

The results also provide some practical implications. The first implication lies in the results showing that environmental concerns and beliefs positively affect energy-saving behaviors. The results imply that marketers should emphasize developing strategies to enhance consumers' environmental concerns and beliefs to encourage energy-saving behaviors. One of the marketing strategies can be adopting marketing communication campaigns using various appeals, such as rational and emotional appeals.

The second practical implication lies in the results showing that respondents with higher education have higher environmental concerns, which leads them to engage more in energy-saving behaviors. Marketers can encourage this market segment to adopt energy-saving products requiring more complex knowledge. Marketers can also apply these marketing tactics to wealthier consumers. Wealthier consumers engage more in energy-saving behaviors because they have a stronger belief in the importance of nature. This segment can be a potential market for technology-based products, such as electric vehicles and solar power generators for homes. Moreover, with their higher cognitive ability and purchasing power, highly educated and wealthier individuals can be persuaded to adopt other sustainable consumer behaviors, such as sustainable product sourcing or consumer activist behaviors.

The third practical implication lies in the results showing that certain groups of consumers, i.e., older, less wealthy, and those with lower levels of education, did not engage enough in energy-saving behaviors. The results imply that marketers and policymakers must encourage them to engage more. For less wealthy individuals, the price premium of products with energy-saving features might hinder their adoption of energy-saving products. Marketers may want to provide different product lines with a broader price range, allowing consumers to choose affordable products. For older individuals, marketers can support them by eliminating their physical and psychological constraints to engage in energy-saving behaviors.

Lastly, there is an implication for policymakers towards consumers with lower than college degrees. The task is to encourage them to engage more in energy-saving behaviors. Policymakers may want to create easy-to-comprehend guidelines or educational programs to educate this market segment. The information should be easy to comprehend and provide concrete guidelines for activities they should do or avoid. Also, scientific information must be simplified so that non-college graduates can easily understand and follow through.

Limitations and Recommendations

This study is not without limitations. First, the sample used in this study is from one province in Thailand. As a result, the findings cannot be generalized across the country. Moreover, this study focuses solely on energy-saving behaviors. Prior studies have mentioned several categories of pro-environmental behaviors that research scholars can consider in social marketing, such as waste reduction, water-saving, and emission reduction (White et al., 2019). Future research should expand the investigation to cover these behaviors to see if the findings in this study are still valid in other contexts.

Given that prior research often reported the impact of gender on sustainable consumer behaviors, it is surprising that we did not find the impact of gender in our results. This result might be because the sample investigated in this study comprises only parents or caretakers. Parents or caretakers usually care about their children's future and always have the children's benefits in mind. As a result, the parent's or caregivers' energy-saving behaviors may not differ even though they are of different genders. Future research needs to examine a wider audience, covering samples of non-parents to verify this assumption. In addition, due to the limitation of secondary data, this study did not consider the impact of environmental knowledge on energy-saving behaviors. Since prior research has noted that subjective and objective knowledge could affect pro-environmental behaviors, future research should also consider the impact of environmental knowledge on energy-saving behaviors. Doing so should help test the robustness of the results regarding the impact of education on energy-saving behaviors.

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