



Factors affecting tourist's intention to purchase environmentally friendly sunscreen products: A case study of Phuket, Thailand

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Abstract

The purpose of this study was to examine the effect of visitors' environmental knowledge, attitudes, and perceptions of the marketing mix on their intentions to purchase environmentally friendly sunscreen products. This research was conducted in Phuket, a prominent international destination whose tourism resources, notably its marine ecosystem, are under severe pressure as a result of the over tourism dilemma. The sample size was determined using a convenience sample of 400 visitors. A closed-ended structure questionnaire was used to collect prerequisite data. Descriptive statistics were used to summarize the sample's characteristics, as well as their knowledge and attitude toward environmentally friendly sunscreen products, while multiple regression analysis was used to verify the factors influencing visitors' intention to purchase the products. The findings revealed that despite tourists' inadequate knowledge about environmentally friendly sunscreen products, their attitudes toward such items were favorable. The regression analysis revealed that attitude, price, and place all played a significant role in predicting purchasing intention. The study concluded that a strategy should be devised to enhance environmental knowledge and awareness, while emphasizing price and distribution strategies that make tourist consumption more affordable and accessible, thereby directly contributing to the alleviation of marine life concerns.

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Introduction

Numerous studies have demonstrated that the development of the tourism industry has played a critical

role in economic and social development ranging from the local community to the global level (Sun et al., 2020; Winter & Kim, 2020). The success of the tourism industry, however, comes at the expense of environmental degradation (Amuquandoh, 2010), which necessitates a significant amount of effort and financial resources to address. This research was motivated by the environmental crisis that has resulted from the over-exploitation of natural resources for tourist activities and consumption by using Phuket as a case study.

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Phuket, commonly known as “*the Pearl of Andaman Sea*”, is a major tourist destination in the south of Thailand (Taecharungroj & Mathayomchan, 2019) with a high capacity for the international market. The island’s main attractions rely on geographical diversity, including marine life, beautiful beaches, seawater quality, and a tropical climate (sea, sun, sand). According to the Department of Tourism, since 2009 the number of visitors to Phuket has been increasing enormously. By 2017, its visitors had increased 4.26 times compared to 2009 (Department of Tourism, 2017) before dropping abruptly because of the COVID-19 pandemic situation in 2020. However, it is forecasted that by the end of the crisis, Phuket will continue to gain immense popularity among tourists, as evidenced by a survey carried out by TripAdvisor, showing that Phuket has been voted by tourists worldwide as a “*Traveler Choice*” (Sangkaew & Zhu, 2020).

Despite the fact that tourism generates a significant amount of revenue for the country, the accelerating increase in the number of tourists is directly damaging the environment (Ruhanen, 2004; Simpson, 2001). Various environmental impacts, such as garbage problems, as well as the discharge of untreated water from the tourism business sector and the encroachment of conservation areas (Dearden et al., 2007; Sakolnakorn et al., 2013) were frequently mentioned and reported in Phuket and the surrounding areas (Tuntipositkul, et al., 2021). These environmental issues raise concerns among tourism stakeholders on the island since Phuket’s tourism industry is primarily reliant on natural resources to operate at a high level. According to a report by the Department of Marine and Coastal Resources (2013), environmental problems created by the beach and sea-based activities are of great concern, particularly for marine life such as corals, whose population is quickly diminishing.

Corals are essential components of marine ecosystems (Lauria et al., 2017). It is now apparent that coral reefs around the world are susceptible to the impact of global warming and many human activities. One of the human activities that can cause the dying process on the coral reef was directly connected to the use of sunscreen products by tourists (Moeller et al., 2021). Sunscreen products, which have long been extensively used to protect against UVA and UVB radiation, have recently been found to be harmful to coral reefs. Sunscreen chemicals such as Oxybenzone (Benzophenone-3, BP-3), Octinoxate (Ethylhexyl methoxycinnamate), and 4-Methylbenzylid Camphor (4MBC) contribute to coral reef degradation. These toxins damage immature corals, disrupt DNA, making it impossible for corals to reproduce, and cause coral bleaching (Mitchelmore et al., 2019).

A number of countries have begun to manage and implement control measures in response to the findings. For instance, Palau, the Philippines, which is known as the world’s most famous diving destination, has passed a law prohibiting the use of sunscreen on its diving sites. In addition, importing or selling any type of sunscreen will also be prohibited, while any sunscreen imported by tourists will be confiscated and destroyed. Any violators have faced a fine of USD1,000 since the beginning of January 2020. Likewise, Hawaii has passed a law to ban the use of sunscreens that contain oxybenzone and octinoxate, which are known to harm coral reefs (Adler & DeLeo, 2020). However, there is no law in Thailand prohibiting the use of such chemicals. Moreover, public awareness of the negative effects of chemical sunscreens on corals is still limited (Adler & DeLeo, 2020).

Although the marine environment is deteriorating, sunscreen consumption is still in high demand among marine tourists today (Vergilio & da Rocha Filho, 2020). It is critical to encourage tourists to use environmentally friendly sunscreens in order to ensure the survival of coral reefs and the integrity of marine ecosystems. However, in order to run the project successfully, tourism marketers and planners must understand tourists’ knowledge and attitudes about green products, as well as analyzing the marketing mix (4P’s) that can influence tourist purchasing decisions. This is because tourists’ knowledge and attitudes have a direct impact on decision-making behavior (Kim et al., 2021). Additionally, there are relatively few studies on knowledge and attitudes, as well as marketing elements influencing the intention to purchase environmentally friendly products in Thailand, particularly from tourists’ perspective regarding the purchase of coral-friendly sunscreen products. The objectives of this study were twofold: (1) to assess tourists’ current knowledge and attitudes about environmentally friendly sunscreen products, as well as the impact of the marketing mix; and (2) to identify factors affecting the intention to purchase environmentally friendly sunscreen products.

Literature Review

Green Products Purchasing Intention

Green or eco-friendly products could be defined as “*one constituted of materials and associated with production practices along its entire life cycle recognized for being socially and environmentally responsible*” (Cai et al., 2017, p. 203). Since unsustainable purchasing and consumption of these goods can cause significant impact on the

environment (Joshi & Rahman, 2015), thus, green products purchasing and consumption play a vital role in the environmental crisis as such reduces harmful impacts on the environment, society and supports sustainable development (Tanner & Kast, 2003).

Consumers' purchasing intention is defined as a positive intention or cognitive activity to buy things (Ling et al., 2010; Mohd Sam & Tahir, 2009). According to (Whitlark et al., 1993), purchase intention is when people decide to buy something after evaluating it. Within that context, green product purchasing intention is defined as the likelihood and desire of a consumer who is interested to choose a more environmentally friendly product compared to conventional products. (Lasuin & Ching, 2014; Ramayah et al., 2010).

Factors Affecting Green Purchase Intention

In order to promote green products successfully, marketers must pay more attention to understand consumer green product preferences and behavior (Cherrier et al., 2011) since consumers' green purchase intention is an important element of consumers' behavior, and studying the factors affecting consumers' purchase intention is vital for companies to develop marketing strategies (Sana, 2020). There are numerous past studies which explored the factors influencing consumers' green purchase intentions such as knowledge, attitude, marketing mix (4Ps), sociodemographic (Sun & Wang, 2019; Witek & Kuźniar, 2020; Zhuang et al., 2021). Thus, this study divides the factors influencing consumers' green purchase intention into three categories as follows.

Knowledge

Any information that is retained in one's memory is considered consumer knowledge. A person's purchasing decision is influenced by the information stored in his or her memory. This knowledge is divided into three phases: product knowledge, purchase knowledge, and usage knowledge (Blackwell et al., 2006). Knowledge of green products has the potential to influence the use and purchase of those environmentally friendly products. According to Anderson et al., (2006), specific knowledge of the characteristics of organic foods can be the key to purchasing those products. Kaiser and Schultz (2009) concluded that knowing more about the environment can help individuals become more environmentally conscious. Previous studies found that consumers with greater knowledge of environmental issues display a stronger intention towards purchasing green products (Amran, 2012; Mostafa, 2007)

Attitude

Attitudes are sets of beliefs about a specific object or action that can lead to a desire to carry out the action (Schwartz, 1992). Attitudes of environmental concern are rooted in a person's concept of self and the degree to which an individual perceives himself/herself to be an integral part of the natural environment (Zelezny & Schultz, 2000). It can be concluded that attitude reflects what customers like and dislike (Blackwell et al., 2006). Previous research studies (Chan, 2001; Tanner & Kast, 2003; Vermeir & Verbeke, 2006) have shown that having a positive attitude can lead to purchasing environmentally friendly products.

Marketing Mix

Product, price, place, and promotion, commonly known as the 4Ps, make up the marketing mix (Kotler & Keller, 2016). Understanding the marketing mix allows marketers to determine how they should invest in the 4Ps to meet customers' expectations (Kotler & Keller, 2016). Due to customer concern about the environment, the marketing mix has become extremely important in the manufacture of eco-friendly products. Wanninayake and Randiwela (2008) state that there is a relationship between the elements of the marketing mix, i.e. product, price, place, and promotion, as well as how each of these variables correlates to the purchase decision. For instance, a study by Maletić et al. (2010) discovered that despite the higher price, people have a positive purchase intention for environmentally friendly products.

Sociodemographic Factors

Past studies on green purchasing intention suggested that sociodemographic factors such as gender, age, income etc. should be considered with an aim to explore the cause and effect relationships since it has been found to influence green purchasing intention (Bryła, 2016). Moreover, marketers often used sociodemographic profiles when conduct consumer segmentation and profiling for new green products, considering that this segmentation process is easily done and valuable (Patel et al., 2017). For instance, previous studies found that women are more inclined to buying green products than men (Irianto, 2015; Ureña et al., 2008). Another study found that women had greater concern for the environment and willingness-to-pay more for green products (Han et al., 2009). Age is another variable that has been widely examined in the past since it provides a useful insight for

market segmentation (Bryla, 2016). Further research is needed to determine whether these characteristics play a significant role in profiling green consumer. Therefore, this study also attempted to gain an understanding of how sociodemographic factors affect purchasing intention towards environmentally friendly sunscreen products.

The conceptual framework for this study is developed on the basis of the literature reviews, as shown in Figure 1.

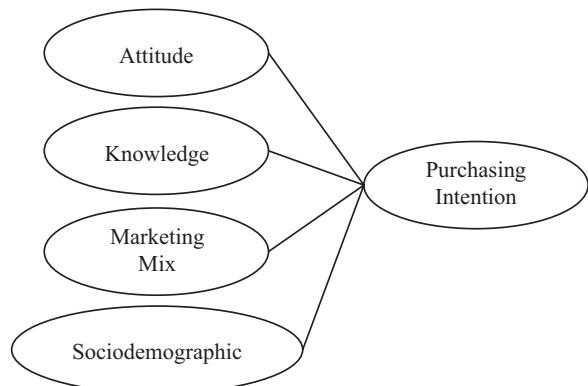


Figure 1 Conceptual framework of the study

Methodology

Population and Sampling

The survey was conducted in March 2019 among visitors to Phuket. Due to challenges in determining the actual number of visitors who use sunscreen, the sample size was determined using Cochran's (1977) method for unknown population sampling. After screening the responses, a total of 400 were determined to be usable as samples for analysis. Hair et al. (2010) believe that this figure is appropriate for statistical analysis (2010). Additionally, Bagozzi and Yi (2012) recommended that studies have at least 100, preferably more than 200 participants.

Questionnaire Development

To gather data, a self- administered questionnaire divided into five sections was constructed based on previous literature reviews (e.g., Arli et al., 2018; Phuah et al., 2018; Taufique et al., 2014). The first section of the questionnaires was designed to gauge data on tourists' current knowledge of the effects of sunscreen on corals. The second part assessed tourists' attitudes toward

environmentally friendly sunscreen products. The third section asked about how the marketing mix influenced their decision to purchase environmentally friendly sunscreen products. The fourth section investigated the possibility of purchasing environmentally friendly products and the final section examines the respondent's profile. All of the items in part 2–4 were on a five-point Likert scale with 1 meaning "Strongly Disagree" and 5 meaning "Strongly Agree". In order to ensure the face validity, a careful screening for appropriate and relevant questions was reviewed by three academic professionals in tourism. The internal consistency of the measurement scales was confirmed using a reliability test, which yielded a Cronbach's alpha value of .923, which was considered acceptable (Pallant, 2013).

Data Analysis

A convenience sampling technique was used to collect 400 questionnaires from tourists visiting Phuket at various beaches and tourist attractions. The information gathered was analyzed using computer software (SPSS). Descriptive statistics such as frequency, percentage, and standard deviation were used to summarize the sample's characteristics, knowledge of the effect of sunscreen on corals, attitude toward sunscreen products, and the influence of the marketing mix on the purchase decision. The effect between factors and the purchasing intention for environmentally friendly sunscreen products was then determined using multiple regression analysis. This technique is useful when the purpose of the study is to predict changes in the dependent variable as a result of changes in the independent variables.

Results

The analysis revealed a good distribution of male and female samples. The majority of respondents were aged between 22 and 39 years old (68.50%), followed by 40–54 (17.00%), above 55 (10.75%) and below 21 (3.75%). Respondents were from Europe (32.50%), Asia (24.00%), Oceania (18%), China (15.00%), and America & Africa (10.50%). The majority of the respondents had a bachelor's degree (48.75%) and were employed in a company (50.25%). In addition, a large number of respondents earned less than 50,000 THbaht (30.25%), followed by those earning between 50,000 to 100,000 THbaht (28.75%), 100,001–150,000 THbaht (16.00%), 150,000–200,000 THbaht (14.50%), and above 200,001 (10.50%) (See Table 1).

Table 1 Sociodemographic profile of the respondents

Variable	Frequency	Percentage (%)
Gender		
Male	189	47.25
Female	211	52.75
Age (years)		
21 <	15	3.75
22–39	274	68.50
40–54	68	17.00
> 55	43	10.75
Education level		
Below high school	6	1.50
High school or equivalent	104	26.00
Bachelor's degree	195	48.75
Above Bachelor's degree	95	23.75
Monthly income (Thai baht)		
< 50,000	121	30.25
50,001–100,000	115	28.75
100,001–150,000	64	16.00
150,001–200,000	58	14.50
> 200,001	42	10.50
Occupation		
Student	37	9.25
Company employee	201	50.25
Civil servant	37	9.25
Self-employed, Private business	77	19.25
Others	48	12.00

Knowledge on Marine Environmentally Friendly Sunscreen Products

In this study, tourists were asked ten questions related to marine and environmentally friendly sunscreen products. There were three options for the questions: “*correct*,” “*incorrect*,” and “*don't know*.” It was found that 27.85 percent were able to correctly answer the questions. On the other hand, around two-thirds (63.00%) stated they had no idea, while 9.15 percent answered

incorrectly. Out of the ten questions, the question “*Corals are home to one-fourth of all marine life*” obtained the most correct answers (48.75%). The most prevalent incorrect answer was for the question “*marine environmentally friendly sunscreen products must be purchased at a specialty store, as they cannot be purchased at a convenience store*” with 83 tourists (20.75%), while 329 tourists (82.25%) responded “*do not know*” to the question: “*There is no marine environmentally friendly sunscreen product available in Thailand*.” It should be noted that none of the 400 tourists received a full score while only four tourists received a maximum score of 8 out of 10. Also, 82.50 percent of tourists received less than 5 points, with 20.50 percent receiving no points.

The total score of respondents was then analyzed and classified into three groups based on their level of knowledge. **Table 2** shows the result where the majority, with 261 tourists (65.25%), had a low level of knowledge, while 135 tourists (33.75%) had a moderate level of knowledge, and 4 tourists (1.00%) had a high level of knowledge and understanding on environmentally friendly sunscreen products. These findings revealed that the majority of tourists still lacked fundamental knowledge and understanding on environmentally friendly sunscreen products.

Tourist's Attitudes on the Environmentally Friendly Sunscreen Product.

Table 3 summarizes the result of tourist's attitudes on environmentally friendly sunscreen products. The respondents' overall attitude toward environmentally

Table 2 Level of tourist's knowledge on the effects of sunscreen on the marine environment.

Level of Knowledge	Frequency	Percentage
Poor (0–3 scores)	261	65.25
Moderate (4–7 score)	135	33.75
Good (8–10 score)	4	1.00
Total	400	100.00

Table 3 Tourist attitude toward environmentally friendly sunscreen product

Statement	Mean	SD	Level of agreement
I would like to be a part of the responsibility for protecting the marine ecosystem.	4.09	1.01	Agree
I believe that environmentally friendly sunscreen is a new concept that needs to be taught in order for people to fully comprehend the product purposes.	4.41	0.80	Strongly agree
I believe that encouraging others to use environmentally friendly sunscreen products is a good idea.	4.44	0.81	Strongly agree
I believe that purchasing an environmentally friendly sunscreen is a good way to protect the ocean.	4.40	0.83	Strongly agree
I believe the government sector should do more to encourage people to use environmentally friendly sunscreen.	4.41	0.88	Strongly agree
Total	4.35	0.75	Strongly agree

friendly sunscreen product was found to be at the most favorable level with a mean value of 4.35 and a standard deviation of 0.75. Specifically, they strongly agreed with the following statements: “*I believe that encouraging others to use environmentally friendly sunscreen products is a good idea*”, with a mean value of 4.44 and a standard deviation of 0.81; “*I believe that environmentally friendly sunscreen is a new concept that needs to be taught in order for people to fully comprehend the product purposes*”, with a mean value of 4.41 and standard deviation of 0.80; “*I believe the government sector should do more to encourage people to use environmentally friendly sunscreen*” with a mean value of 4.41 and standard deviation of 0.88; and “*I believe that purchasing marine environmentally friendly sunscreen is a good way to protect the ocean*” with a mean value of 4.40 and standard deviation of 0.83 respectively.

Marketing Mix Elements (4Ps) and Decision to Purchase Environmentally Friendly Sunscreen Products

Table 4 presents the analysis on visitors' overall perceptions of the marketing mix (4Ps) and their decision to purchase environmentally friendly sunscreen products. Since marketers employ the marketing mix, which is comprised of Product, Price, Place, and Promotion (4Ps), to influence market response, tourists were asked to rate

their degree of agreement with these components that may affect their decision to purchase environmentally friendly sunscreen products. The study found that visitors evaluated 'Place' as the most significant element when considering a purchase, with a high mean value of 4.19 and a standard deviation of 0.80, followed by 'Product', 'Promotion', and 'Price' factors, with mean values of 3.99, 3.87, and 3.79, respectively.

Factors Associated with Intention to Purchase Environmentally Friendly Sunscreen Product

The multiple regression analysis result presented in Table 5 shows that there was a relationship between the three variables, including attitude, price, and place, and the intention to purchase an environmentally friendly sunscreen product ($p < .05$). However, neither the product nor the promotion, nor sociodemographic factors such as gender, age, income, or knowledge, had a significant effect on the purchase decision. When considering the significance value with Prob. $< .05$, it was found that the 'attitude toward environmentally friendly sunscreen product' factors had the strongest impact on the overall intention to purchase, followed by 'place' and 'price' factors, with probability value of .000, .001, and .044 respectively. The results showed that the model could explain 52 percent of the variation in dependent variables.

Table 4 Marketing mix elements and marine environmentally friendly sunscreen products

Factors & Sub-factors	Mean	SD	Level of agreement
I will purchase the environmentally friendly sunscreen if...			
Product	3.99	0.74	Agree
If the product does not destroy marine natural resources.	4.36	0.83	
The product has a good design and is portable.	3.93	1.02	
If the product is a famous brand and a good image	3.47	1.19	
If the product is available in multiple formulas and sizes	4.08	0.95	
If the product has good properties, such as not sticky, oily etc.	4.12	0.99	
Price	3.79	0.70	Agree
If the price is suitable compared to the quality	4.30	0.80	
If the price is appropriate compared to the quantity of the product.	4.15	0.86	
If the price is higher compared to regular sunscreen products	2.92	1.25	
Place	4.19	0.80	Agree
If the product is easy to find and locate	4.37	0.82	
If the product is placed in an easy-to-see place	4.06	1.04	
If the place of sale is close to marine attractions.	3.96	1.14	
If the product is uniquely placed as a marine environmentally friendly product.	4.36	0.88	
Promotion	3.87	0.85	Agree
If advertising is available in various media.	3.68	1.11	
If there is a publicity of the danger of general sunscreen products for the marine environment.	4.16	0.94	
If there are salespeople who can provide an understanding of the details of marine environment friendly products.	3.84	1.08	
If there are free trial products.	3.80	1.26	

Table 5 Predictor of intention to purchase environmentally friendly sunscreen product

Variable	Coe.	SE	t-Statistic	p
Gender	-0.014	0.057	-0.237	.813
Age	0.003	0.002	1.112	.267
Income	0.002	0.003	0.637	.525
Knowledge of environmentally friendly sunscreen product	0.020	0.015	1.353	.177
Attitude toward environmentally friendly sunscreen product	0.594	0.045	13.119	.000*
Product	-0.041	0.052	-0.791	.430
Price	0.102	0.050	2.018	.044*
Place	0.156	0.047	3.315	.001*
Promotion	0.050	0.042	1.208	.228
Constant	0.410	0.220	1.864	.063
<i>R</i> ²	0.520	Durbin-Watson stat		1.867
<i>p</i> (F-statistic)	0.000			

Note: * *p* < .05.

Discussion and Conclusion

By examining tourists' knowledge, attitudes, and intentions to purchase environmentally friendly sunscreen products, this study addresses a present knowledge gap aimed at reducing the negative impact on the environment, especially on the coral reef ecosystem in Phuket, Thailand.

Environmental issues have emerged as a serious problem for Phuket's tourism industry's long-term sustainability (Tuntipisitkul et al., 2021). Today, an increasing number of tourism enterprises place an emphasis on environmentally friendly products, and tourists have an increased interest and desire to purchase such products. This study discovered that visitors to Phuket generally had a positive attitude toward environmentally friendly sunscreen products, which is consistent with previous research such as that of Sarigöllü (2009), and Diekmann and Franzen (1999). Nonetheless, they still had a limited understanding and knowledge of environmentally friendly sunscreen products, which might result in risky behavior with negative environmental repercussions. As Kempton et al. (1996) observed, many people do not have enough knowledge about the environment to act in an environmentally responsible way. Thus, tourism planners and relevant authorities in Phuket should place a high priority on raising awareness about environmentally friendly sunscreen products to protect the coral reef ecosystem, which constitutes a key tourism resource. Such understanding and knowledge can be developed through various forms of communication channels, particularly through social media and the use of the Internet, which are globally accessible to travelers, with

key messages such as the coral reef crisis and how tourists can help protect them by using environmentally friendly sunscreen products. This approach was echoed by Laroche et al. (2001) who explained that the more individuals are aware of environmental concerns, the more likely they are to purchase green items.

Several research studies have found that a range of factors can influence customers' decision to purchase environmentally friendly products. The results of this study revealed that tourists' attitudes toward environmentally friendly sunscreen products play the most important role in their purchasing decisions. This finding is consistent with other earlier studies, which have discovered that attitude is a significant predictor of green purchasing intention (Hartmann & Apaolaza Ibáez, 2006; Jia Yii & Hui Shein, 2020). This could be because consumers' intents to purchase green items are motivated by emotional factors, such as a desire to feel good and more comfortable while doing so (Jia Yii & Hui Shein, 2020). Unlike previous research that established a relationship between knowledge and purchasing intention (Kim et al., 2021), this study demonstrated that knowledge had no discernible effect on individuals' purchasing intentions. However, it is critical to emphasize that environmental knowledge was positively associated with customers' environmental attitudes (Anbukarasi & Dheivanai, 2017). The better-informed visitors were about an environmental issue, the more their attitudes shifted toward environmental consciousness, which directly affects their willingness to purchase eco-friendly items and engage in green purchasing behavior (Rusyani et al., 2021).

When the marketing mix (4Ps) was evaluated, the study revealed that pricing had a substantial effect on visitors' intention to purchase environmentally friendly

sunscreen products. This could be because, while consumers are eager to purchase green items, they are often price sensitive. This finding is consistent with prior research indicating that price sensitivity can have a positive or negative impact on customers' green purchasing intention and behavior. While higher prices have been recognized as a major impediment to consumers purchasing green items (Connell, 2010; Wijekoon & Sabri, 2021), it has been discovered that reduced prices have a beneficial effect on green purchasing behavior (Aertsens et al., 2011; Eze & Ndubisi, 2013). As a result, governments should establish an incentive program, such as subsidies or tax reductions, to assist in making green products and services more affordable, hence increasing their popularity. This would be a win-win scenario for the government, manufacturers, and customers alike. Additionally, the tourist's intention to purchase environmentally friendly sunscreen products was found to be influenced by the aspect of the place. This relationship could possibly be explained by the fact that location is linked to availability in terms of the ease of accessibility, which a product can be obtained or consumed. According to Mainieri et al. (1997), many customers have an intention to purchase green products but do not take action owing to a lack of green product availability. Thus, in order to engage more visitors in the green purchasing process, both online and offline product distribution strategies should be emphasized by tourism destination marketers.

In conclusion, this is the first study to analyze visitors' level of knowledge, attitude, and the effect of marketing mix on their purchase intention in the context of Phuket's tourism industry, which is largely dependent on the beauty and wealth of natural resources. The current study adds to the existing body of knowledge by elucidating the factors that influence a consumer's decision to purchase an environmentally friendly sunscreen product in the tourism industry. Academics, particularly those investigating tourism destination management, as well as Phuket industry practitioners and other policymakers whose destinations are vulnerable to tourism exploitation, will find the findings of this study useful in raising awareness and encouraging the use of environmentally friendly sunscreen products, which will aid in the sustainable recovery of the marine ecological system.

Conflict of interest

The authors declare that there is no conflict of interest.

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