Elucidating the factors influencing the acceptance of green products: An extension of theory of planned behavior

Shih-Chih Chen *, Chung-Wen Hung

Department of Accounting Information, Southern Taiwan University of Science and Technology, No. 1, Nan-Tai Street, Yungkang Dist., Tainan City 710, Taiwan

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ABSTRACT

Recent environmental disasters worldwide have made people consider the need for environmental protection. Therefore, the invisible pressure from these people made a paradigm shift on the economic structure as well as the business strategies. Even if these pressures from the environmental-friendly people are not forceful, it is nevertheless inevitable to put more strategic importance on the environment. The aim of this study was to identify determinants of acceptance of green products, including attitude, subjective norm and perceived behavioral control of theory of planned behavior with social impression, environmental consciousness, and environmental ethics and beliefs to understand and predict the adoption of consumer intentions. An online survey with 406 responses has been analyzed by partial least square (PLS). This study found that the attitude, perceived behavioral control, environmental consciousness of consumers and the environmental ethics and beliefs of consumers have a significant positive association with their intention to use green products, while the subjective norms consumers and the social impression consumers are positively but not significantly correlated to their intentions towards using green products. Based on these results, several strategic suggestions for participators and academics as well as policy implications to promote the green production were offered.

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1. Introduction

Rapid economic development has resulted in overconsumption of natural resources and disruption in the balance of the ecological environment. Global warming, ozone depletion, water and air pollution, and species extinction have become key environmental issues [1]. The borderless competition under the WTO system has resulted in prosperous global economic development. Unfortunately, this ever increasing demand for the economic development brought the unbearable side effect of climatic anomalies, as can be seen by the endless stream of natural disasters, including mudslides, hurricanes, floods, and droughts, around the world in recent years and the loss and damage these climate changes bring. Kates [2] pointed out that overpopulation and excessive consumption are the main causes of today's ecological and environmental crises. These problems are especially severe in Northeast Asian countries such as China, Korea, and Taiwan due to their high population densities. The dense population living in each developed and developing countries has put a lot of pressure on the environment, with the density of sources of pollution continuing to increase and environmental burdens becoming increasingly heavy. These environmental pressures have forced to reconsider and reflect upon the relationship between human beings and nature because the extraction of natural resources is a disposable factor in the development of human civilization [3,4]. Thus, the idea of environmental protection has begun to gradually emerge in people's minds.

Green consumption is one way to increase environmental sustainability. When green consumers are aware of the deteriorating environment and develop a more responsible attitude toward environmental protection, their consideration will include in their purchase decisions, leading them to buy products which have minimal impact on the environment [5]. Green products are defined as products produced using techniques and chemicals used for various environmental services such as sewage treatment, solid-waste management, air-pollution control and other service which are all aimed for environmental protection [6]. According to Nimse et al. [7], green products can be defined as products that are composed of recyclable materials and are manufactured using water- and energy-saving methods to reduce waste, package and times of toxic materials disposal. Seyfang [6] also indicated products produced and service offered by green products and service industries can be used to measure, prevent, limit, reduce or repair environmental damages to water, air and soil and deal with problems regarding waste, noise and ecosystem which includes technology, products and service in connection with zero-discharge to reduce environmental risk and pollution and to see a decline in the use of resources.

Problems of mass-production, mass-consumption, and mass-disposal resulting from rapid economic growth have raised various

* Corresponding author.
  E-mail addresses: scchendr@stust.edu.tw (S.-C. Chen), cwhung@stust.edu.tw
(C.-W. Hung).

ethical issues. Although most people purchase products every day, few people consider the ethical problems of consumption. The literature indicated that the percentage of environmentally friendly products in the aggregate demand is low [8]. A study by Lai [9] indicated that, if people can think globally and act locally to affect the environment and launch environmental campaigns, the outcomes of such environmental campaigns would be remarkable. The question is how consumers can reduce local environmental burdens. The most direct and efficient way to reduce overconsumption of resources is by changing consumption patterns. Studies such as Málovics et al. [10] also pointed out that reducing consumption levels is beneficial in decreasing global overconsumption of natural resources.

Consumers play a fundamental role in the green revolution because green consumption not only has positive effects on the environment, the economy, and society, but is also essential for sustainable development [1,11]. After comprehensive and profound thinking and reflection regarding the relationship between humans and the environment, the concept of environmental consciousness was introduced in the 1960s. The environmental consciousness development process was formed to meet the urgent demands of human social practices and consists of a multi-layered, comprehensive system with regard to the relationship between humans and the environment [12,13]. Vlek & Steg [14] pointed out that environmental consciousness is the investigation of the decisions people make on the environment with the compromise or contradiction between sustainable environmental quality and immediate economic growth. Growing environmental consciousness profoundly affects consumer demands and behaviors, and consumers are increasingly willing to use green products and contribute more to them [15]. Bansal [16] indicated that people with strong environmental consciousness are more likely to engage in environmentally-friendly activities. Therefore, this study used environmental consciousness as a way to predict consumer behavior.

Consumer acceptance of innovative products is widely studied in the field of information management [17]. Since the 1980s, many studies have combined information management, sociology, and psychology to develop theories for explaining or predicting user acceptance of technology products [18]. The theory of planned behavior has been often used to study the relationship between people's beliefs, attitudes, and behavioral intentions, including green consumption behavior [19], ecological behavior [20], readiness for environmental protection [21], marketing of environmentally friendly products [22] and choice of green hotels [23,24]. However, although previous studies have used the theory of planned behavior to explain behavioral intentions, few studies have examined environmental cognitions of individuals. Therefore, this study used an extended theory of planned behavior model to analyze empirical data and learn about behavioral intentions relating to green consumption. The implications of this study can be considered when introducing environmental policies, developing corporate environmental consciousness, and promoting green consumption in the hopes of increasing social environmental consciousness and achieving environmental sustainability.

The remainder of this study is organized as follows. In Section 2, we reviewed relevant literature pertaining to the related factors and developed the research hypotheses. Afterwards, we presented the research methodology in Section 3, and demonstrated the analysis results in Section 4. Finally, Section 5 presents our findings, theoretical and practical implications, and limitations of this research.

2. Literature review

2.1. Theory of planned behavior

The theory of planned behavior is an extension of the Theory of Reasoned Action (TRA) and the multi-attribute attitude model [25,26]. One of the earliest and widely applied models, TRA was introduced by Fishbein and Ajzen and assumes that individual behavior can be controlled at will. However, TRA cannot fully explain human behavior since, in reality, different factors may affect behavioral intentions. As such, Ajzen [25] extended TRA and proposed theory of planned behavior as a model which can more accurately predict and explain human behavior.

The core argument of theory of planned behavior is that human behavior results from rational choices rather than from willful action and is influenced by attitude, subjective norm, and perceived behavioral control through their effect on behavioral intentions. Restated, human behavior is governed by behavioral intentions, which are in turn influenced by attitude (evaluation of the target behavior), subjective norms (judgment about others' potential attitude toward the target behavior), and perceived behavioral control (perceived ability of performing the target behavior).

Many studies agreed that theory of planned behavior accurately predicted many different behaviors. Hagger et al. [27] maintained that the three aforementioned factors can be used to predict behavioral intentions and behavior; however, many other studies suggested that more predictors should be added to theory of planned behavior in order to increase its explanatory ability. Thus, this study integrated additional factors of social impression, environmental consciousness, and environmental ethics in the proposed model used to examine consumer acceptance of green products.

2.2. Social impression

Social impression refers to the thoughts and expectations of society regarding personal behaviors, and the degree to which the extrinsic influence of social impression can affect the confidence and sense of achievement of an individual can be seen as a reflection of position, achievement, respect, and approval, as well as other factors. Long & Shiffman [28] believed that consumer use or selection of products can reveal either a desire to belong to a particular group or, conversely, an unwillingness to be a part of it. Thus, consumers may give positive feedback regarding certain brands due to social impression. One example is how owning a certain product can gain the consumer a good reputation within a group or groups that he or she desires to join.

According to the Maslow hierarchy of needs [29], all human behavior arises from needs, and all individuals, regardless of their cultural backgrounds, have five basic needs. These needs can be divided into 5 levels according to their degree of priority. Starting from the bottom level, the need of each level must be satisfied before the individual moves to the next level and attempts to satisfy the corresponding need. The highest level needs, in other words, follow the most fundamental needs (the most primary ones) in terms of priority. From the lowest, most fundamental level to the highest, the needs are physiological needs, safety needs, love and belonging needs, esteem needs and self-actualization needs. Among these, esteem needs refer to the need for self-esteem and the need to be valued by others. Esteem refers to feelings of achievement and feelings of being valued by others based on personal achievements, position and appearance. In other words, individuals usually desire to be esteemed and valued by others. Consequently, human behavior involves the pursuit of self-actualization, socio-economic position, a sense of honor and a sense of achievement.

2.3. Environmental ethics and beliefs

Attfield [30] pointed out that traditional ethics emphasizes interpersonal ethics while environmental ethics emphasizes the obligations and duties people have to the environment. Another study by Ferkany & Whyte [31] pointed out that, in the context of a community, we should meet moral obligations and advocate the cultivation of environmental ethics education, which includes knowing the role environmental ethics has played in environmental policy and the responsibilities we bear in terms of problem solving. Additionally, Swanton [32] mentioned that we must understand that environmental ethics is appropriate to the

maintenance of ecological balance but becomes inappropriate from the perspective of species chauvinism.

According to social cognition theory, personal beliefs are what can lead to a behavior or mission being completed successfully when engaging in a certain behavior or mission [33]. Harvey [34] believed that an individual belief is a symbol that aids the individual in behaving and thinking effectively in the real world, while Cobb & Hoyer [35] asserted that a belief is a hypothesis regarding an individual's reality which is based fundamental activities oriented by various goals. Unlike attitudes or emotions, a belief involves an element of love and will not change substantially. Beliefs, despite being hidden inside in our minds, are the basis for human behaviors, leading people to make their various decisions.

Environmental ethics and beliefs respect the environment and ensure the ethical connection between humans and the environment. They also dominate the mind, as well as attitudes and behaviors. Under the traditional philosophy, the connection between humans and nature arises mainly from environmental destruction and degradation. Right and wrong environmental activities are believed to depend on the effects and consequences of actions by humans; however, the rise of deontology led philosophers to consider the duties humans have toward the natural environment. This brought about a value change from anthropocentrism to Non-anthropocentrism [36–38]. Nash [39] argued that many human activities that have had great impacts on helping ethics and beliefs cross the giant gap of Anthropocentrism to extend to non-human's world fauna and even to floral and natural ecology.

2.4. Environmental consciousness

Environmental consciousness is an integrated concept that encompasses cognitions, perceptions, concerns and sensibilities regarding environmental problems, as well as thoughts and attitudes towards solutions to such problems and how to maintain and manage the relationship between humans and the environment in order to achieve improved environmental quality [40–42]. According to Bansal [16], undeniably builds personal beliefs and behavioral intention plays a significant role in such consciousness. Environmental consciousness is a composite concept consisting of environmental knowledge, values and attitudes, and this composite concept also reflects broader individual values, characteristics and other intrinsic and extrinsic factors, including social and cultural ones [12].

In contrast with environmental values and environmental attitudes, Rannikko [43] showed that environmental consciousness involves a gradually growing understanding of the meaning and importance of the environment. In sociology, value is explained as a continuous target under normal conditions, and an individual value is harder to change and steadier than an attitude, where attitude refers to inclinations towards positive and negative responses to incidents, characters or objects under certain conditions. However, the more lasting and steadier elements that inform action include knowledge and affective factors, such as knowledge of an environmental problem and the methods to spread consciousness of it and change attitudes towards it. In addition to knowledge and attitudes, environmental consciousness includes the way individuals behave in concrete situations. Therefore, environmental consciousness has been essential for starting the environmental movement and determining its direction. In this background of environmental consciousness, the common view we see is the connection between human beings and nature, between humans and the environment.

2.5. Hypotheses development

Based on the theory of planned behavior, this study divided variables affecting consumer behavioral intention toward using green products into the attitudes towards those products, subjective norms and perceived behavioral control [25].

According to the theory of planned behavior, the main determinant of behavioral intention is attitude. Attitude results from behavioral assessment while behavior and result are functions of behavioral attitude; based on expectancy-value model, behavioral attitude depends on the beliefs and properties of the results of different behaviors. As a result, attitude can be considered an important factor in predicting and describing human behavior [25]. Relevant studies proving attitude lying a great influence on behavioral intention [44,45]. Consequently, we hypothesized that attitude has a positive correlation with using green products and with the behavioral intention to use green products.

H1. Consumer attitude is positively associated with intention to use green products.

Theory of planned behavior explained how consumers bring a certain buying behavior and considered attitude and subjective norm to be the antecedents of implementing a piece of behavior [25]; the predicting factor of social factors is called social norm which is using perceived social pressure to enforce behavior that meets social expectation. This cognition determines the will of whether one performs a certain behavior. If the social expectation is that people should perform a certain behavior, then one should like to perform this behavior; in contrast, if the social expectation is that people should not perform this behavior then one should not like to perform this behavior [46].

Several studies have shown that subjective norm indeed has a significant and positive influence on behavioral intention [42,47]. Therefore, our second hypothesis was that using green products has a positive correlation with the behavioral intention to use green products.

H2. Subjective norm is positively associated with intention to use green products.

The belief reflected from perceived behavioral control is about the resources and chances required when enforcing a piece of behavior. There are two parts of this belief. One is showing the availability of resources required for a behavior, which might include money, time and other resources. The second part showing one's confident in being able to perform this behavior [25,48].

Studies in various fields have reported a positive correlation between behavioral control and behavioral intention [49,50]. Therefore, this study hypothesized that perceived behavior in using green products is positively correlated with behavioral intention to use green products.

H3. Perceived behavioral control is positively associated with intention to use green products.

According to the Maslow Hierarchy of Needs [29], all human behavior arises from needs, and the Esteem Needs emphasize that every individual has a need or desire to have self-esteem and to be and valued by others. One gets the basic esteem if he cares how he is valued by others. Since the community has a regulating effect, we consider social impression another variable in predicting behavioral intention to use green products. The existing research has already proved that the positive correlation between social impression and behavioral intention [51,52]. Therefore, we hypothesized that social impression in using green products has a positive correlation with intention to use green products.

H4. Social impression is positively associated with intention to use green products.

Taylor [53] pointed out that creatures have a unique value and solid value is equal, no creature is superior to another. Al-Simadi [54] proposed that beliefs are learnable and it shows one's experience and culture. Pajares [55] pointed out that belief possesses validity, reality, and reliability and is a standard for leading one's thinking and behavior. Consumers or users who have strong environmental concerns are likely to engage in behavior that directly or indirectly protects the environment [56]. Relevant studies of the relations between belief and behavior have verified the positive correlation between belief and behavior. For

example, Mostafa [57] showed that consumer attitudes toward environmental protection, the extent of environmental concern, and cognition have a positive correlation with their willingness to purchase green products. Therefore, we proposed the forth hypothesis as follows.

H5. Consumer environmental ethics and beliefs is positively associated with intention to use green products.

Increased environmental awareness has profoundly affected consumer behavior, expanding the market of green products in an enormous way. Environmental knowledge, attitude, and behavior are the standards for measuring individuals' understanding toward a certain or general environment, ecology, or information of actual energy-saving and should be included in any operationalizable environmental awareness [58]. Consumers who have high environmental awareness have environmentally friendly attitudes; that is, individuals with high environmental awareness will show a preference towards green products [16]. Schlegelmilch et al. [58] further noted that environmental awareness affects consumer buying behavior in new environments; in other words, buying behavior in an environment is closely related to environmental awareness.

Since the literature indicate that EC has a positive correlation with behavioral intention [15,16], we hypothesized, we assume a positive correlation between consumer social awareness in green products and the intention in using green products.

H6. Consumer environmental consciousness is positively associated with intention to use green products.

3. Research method

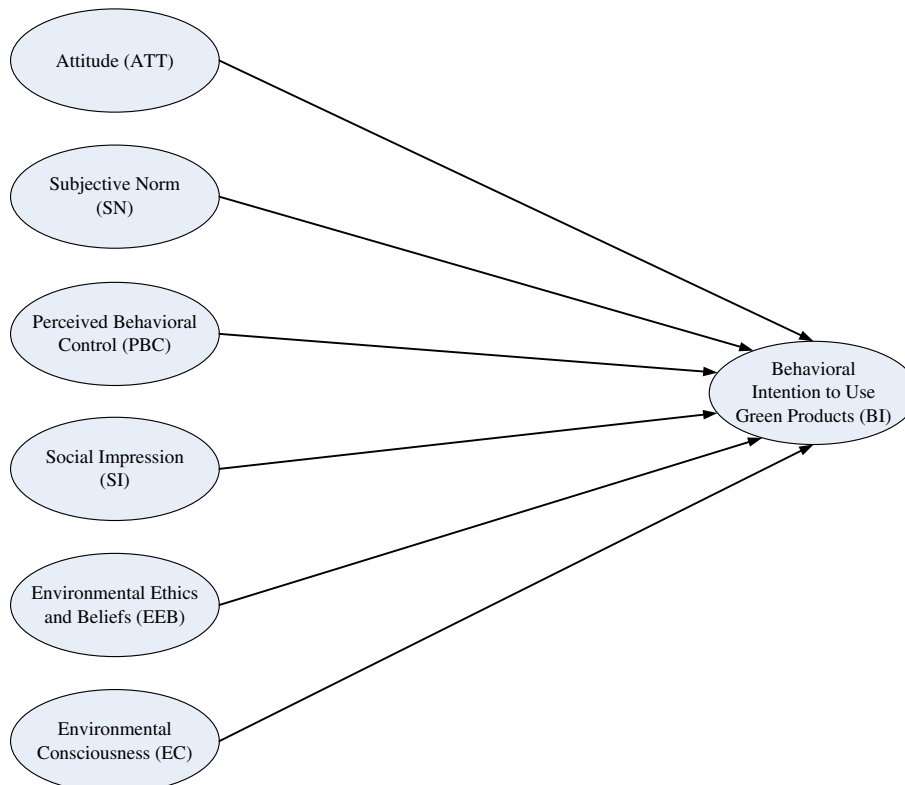According to the literature review and hypotheses development, the proposed model is presented in Fig. 1 above.

This research developed multi-item measures for each construct through the following process. First, all the constructs and the corresponding measurement items were developed by adapting the relevant and existing literature to suit the theme and context of this study. Since the questionnaire from the prior studies was originally developed in English, a university professor with special training in English–Chinese translation translated it into Chinese. Another proficient translator executed a back-translation to ensure that the original translation was precise. Second, after the draft was designed, a pretest was performed on consumers and experts ($n = 35$) familiar with green products adoption to modify the terminology, clarity of instructions and response format and ambiguous expressions so that further problems with the measures could be detected. Finally, improved by the literature review and field interviews, thirty items for six constructs are finally selected. For all measurement items, a seven-point Likert scale was used with anchors ranging from strongly disagree (1) to strongly agree (7). This study analyzed the following three dimensions of theory of planned behavior: attitude (4 items), subjective norm (5 items) and perceived behavioral control (4 items), respectively, which were modified from Taylor& Todd [48] and Bhattacherjee [49]. Four items for social impression were adapted from the ideas of Venkatesh et al. [59] and Chen et al. [60]. Environmentally ethics and beliefs with environmental consciousness were measured using four and nine items separately modified from Schlegelmilch et al. [58] and Chen et al. [15]. Finally, behavioral intention to purchase and use green products was measured using 4 items modified from Taylor& Todd [48] and Bhattacherjee [49]. Table 1 shows the measurement items, operational definitions, and sources of measurement constructs.

Consumers with experience purchasing and using green products were invited to participate in the survey. The respondents were instructed to answer all questionnaire items based on their experience using green products. The survey focused on respondents with experience purchasing and using green products in order to improve external

Fig. 1. Research framework.

Table 1
Operational definition of constructs and measurement items.

Construct	Definition	Source
Attitude (ATT)	Consumers themselves realized using green products has positive or negative impacts on improving environmental quality	Ajzen [25]; Taylor& Todd [48]; Bhattacherjee [49]
Subjective norm (SN)	Significant others of consumers either strongly support or strongly against the using green products	Ajzen [25]; Taylor& Todd [48]; Bhattacherjee [49]; Chen et al. [50]
Perceived behavioral control (PBC)	Consumers realized personal control over the ability, resources, chances and others factors required in using green products	Ajzen [25]; Taylor & Todd 49; Hinds & Sparks [42]; Fielding et al. [47]
Social impression (SI)	The perception can satisfy consumers' needs of positions, achievements, approvals, respect and others when using green products	Venkatesh et al. [59]; Chen et al. [60]
Environmental ethics and beliefs (EEB)	The degree of consumers' environmental ethics and beliefs on using green products	Schlegelmilch et al. [58]; Chen et al. [15]
Environmental consciousness (EC)	The degree of consumers' environmental awareness (environmental knowledge, environmental attitude, and environmental behavior) on their using green products	Schlegelmilch et al. [58]; Chen et al. [15]
Behavioral intention (BI)	Intention and willingness of consumers using or purchasing green products	Ajzen [25]; Taylor& Todd [48]; Bhattacherjee [49]

Table 3
Purchase experience of green products.

Item	Frequency	Percent (%)
Recyclability	325	28.0%
Resource saving	297	25.5%
Recyclable materials	295	25.4%
Low-pollution	245	21.1%

Note: respondents were allowed to choose more than one items in the category.

sizes. [64]. Besides, PLS can comply with normality and presents a more lenient randomness requirement with the complex predictive research model [65–68]. Correlation matrix is shown in Table 4.

According to the suggestions of Hair et al. [69], the factor loadings should be at least 0.5 higher will it makes sense. Three items measuring environmental ethics and beliefs and environmental consciousness had factor loadings of <0.50 on its respective construct; thus, the three items were dropped. All standardized factor loadings of pointer variables in each construct were above 0.5, which met the standard for further analysis (as shown in Table 5).

Internal consistency was measured using composite reliability. Nunnally & Bernstein [70] indicated that a composite reliability higher than 0.7 meets the fidelity requirement. Table 5 shows that all composite reliability values exceeded 0.7, which indicated acceptable internal consistency.

Convergent validity refers to the strength of the correlation between direct observed variables in one construct. The higher the correlation degree, the higher the convergent validity will become. Fornell & Larcker [71] pointed out that the test of convergent validity should meet the following standard:

- Factor loadings in each construct should be larger than 0.7
- Composite reliability should be larger than 0.6
- Average Variance Extracted (AVE) should be larger than 0.5.

Table 5 shows that, except for two environmental consciousness indicators that had standardized factor loadings lower than 0.5, all remaining measurement items had factor loadings higher than 0.7. However, the standardized factor loadings' t-value of these three items were rather distinctive which means a typical sense in them to keep. The standardized factor loadings were all higher than 0.5 and complied with suggestions by Hair et al. [69]. Additionally, Table 5 shows that the standardized factor loadings, composite reliability, and AVE were are all higher than the values suggested by Fornell & Larcker [71]. Thus, all constructs showed good convergent validity.

In this study, discriminant validity is to test mainly for the difference of each construct under external schema. The standardized factor loadings of variables were compared with cross-loadings. Standardized factor loadings higher than the cross-loadings for a variable indicated discriminant validity. For example, the standardized factor loading for

validity. Convenience sampling was adopted in this research along with an online survey for sample collection lasting for 3 weeks. 460 questionnaires distributed, 428 valid questionnaires were returned, and each respondent received a Family Mart Coupon worth NT$50 as a token of gratitude. After discarding the redundant and incomplete questionnaires, the effective sample size was 406. Tables 2 and 3 list the sample demographics.

4. Analysis result

4.1. Analysis of outer model

To assess the outer model of the factors and to test the inner model and relevant research hypotheses, a two-stage approach recommended by Anderson & Gerbing [61] is adopted. This research employed a partial least squares (PLS) method to assess the outer model and inner model. SmartPLS 2.0 software was selected as the PLS analytical tool [62]. SmartPLS is one of the component-based structural equation model (SEM) analytical technique. Compared to other covariance-based structural equation modeling and analysis methods, PLS offers the additional advantage of enabling simultaneous evaluation of both the outer model and the inner model [63], and appropriate for analyzing small sample

Table 2
Demographic attributes of the respondents.

Characteristic	N = 406
Gender	
Female	156 (38.4%)
Male	250 (61.6%)
Age	
Under 20	29 (7.1%)
21–30	95 (23.4%)
31–40	130 (32.0%)
41–50	102 (25.1%)
51 above	50 (12.3%)
Marriage	
Single	193 (47.5%)
Married	213 (52.5%)

Table 4
Correlation matrix.

	ATT	SN	PBC	SI	EEB	EC	BI
ATT	**1.000**						
SN	0.449	**1.000**					
PBC	0.499	0.529	**1.000**				
SI	0.302	0.469	0.460	**1.000**			
EEB	0.490	0.338	0.403	0.200	**1.000**		
EC	0.693	0.539	0.650	0.392	0.569	**1.000**	
BI	0.618	0.503	0.627	0.377	0.563	0.720	**1.000**

Note: ATT = Attitude; SN = Subjective Norm; PBC = Perceived Behavioral Control; SI = Social Impression; EEB = Environmental Ethics and Beliefs; EC = Environmental Consciousness; BI = Behavioral Intention.

Table 5
Factor loadings, reliability and convergent validity.

	ATT	SN	PBC	SI	EEB	EC	BI	Composite reliability	AVE
ATT1	**0.887**	0.378	0.434	0.204	0.455	0.607	0.544	0.916	0.732
ATT2	**0.875**	0.416	0.458	0.322	0.413	0.571	0.533		
ATT3	**0.840**	0.347	0.437	0.235	0.376	0.616	0.477		
ATT4	**0.819**	0.390	0.379	0.272	0.426	0.580	0.555		
SN1	0.353	**0.787**	0.423	0.310	0.255	0.383	0.350	0.910	0.669
SN2	0.369	**0.814**	0.378	0.367	0.213	0.408	0.377		
SN3	0.330	**0.866**	0.438	0.414	0.307	0.424	0.394		
SN4	0.408	**0.865**	0.467	0.468	0.322	0.516	0.458		
SN5	0.364	**0.750**	0.444	0.338	0.270	0.450	0.453		
PBC1	0.404	0.505	**0.845**	0.376	0.344	0.549	0.512	0.894	0.680
PBC2	0.402	0.440	**0.841**	0.435	0.244	0.505	0.491		
PBC3	0.334	0.416	**0.842**	0.428	0.273	0.468	0.454		
PBC4	0.479	0.383	**0.768**	0.292	0.436	0.596	0.585		
SI1	0.313	0.465	0.445	**0.934**	0.252	0.398	0.379	0.970	0.889
SI2	0.295	0.439	0.440	**0.960**	0.173	0.380	0.356		
SI3	0.294	0.430	0.422	**0.950**	0.186	0.364	0.358		
SI4	0.231	0.431	0.428	**0.929**	0.134	0.332	0.323		
EEB2	0.441	0.337	0.388	0.249	**0.889**	0.499	0.521	0.863	0.760
EEB4	0.411	0.246	0.310	0.090	**0.854**	0.494	0.458		
EC1	0.642	0.422	0.534	0.354	0.416	**0.778**	0.603	0.892	0.513
EC2	0.674	0.402	0.494	0.274	0.442	**0.828**	0.589		
EC3	0.584	0.335	0.464	0.190	0.457	**0.781**	0.559		
EC5	0.271	0.393	0.536	0.392	0.226	**0.528**	0.337		
EC6	0.350	0.493	0.483	0.535	0.309	**0.573**	0.451		
EC7	0.405	0.362	0.411	0.187	0.351	**0.697**	0.421		
EC8	0.445	0.309	0.360	0.128	0.508	**0.715**	0.499		
EC9	0.481	0.416	0.487	0.263	0.489	**0.776**	0.592		
BI1	0.575	0.424	0.625	0.379	0.510	0.648	**0.888**	0.939	0.793
BI2	0.532	0.401	0.412	0.211	0.481	0.592	**0.864**		
BI3	0.525	0.471	0.583	0.377	0.491	0.644	**0.898**		
BI4	0.567	0.490	0.594	0.358	0.522	0.676	**0.911**		

Note: ATT = Attitude; SN = Subjective Norm; PBC = Perceived Behavioral Control; SI = Social Impression; EEB = Environmental Ethics and Beliefs; EC = Environmental Consciousness; BI = Behavioral Intention.

ATT1 was 0.887, and constructive cross-loadings were 0.378, 0.434, 0.204, 0.455, 0.607, and 0.544. That is, the standardized factor loading was much higher than the constructive cross-loadings. Table 5 shows that the standardized factor loadings of variables were all higher than the correspondent cross-loadings, which indicated good discriminant validity in each construct.

Since this study collected responses using self-reported surveys in a single setting, the Harman one-factor examination was used to assess whether common-method bias was present. The assumption is if a single factor or one general factor accounts for the majority of covariance among the measures, this exhibits evidence of common-method bias [72–74]. Harman's single-factor test was performed with the complete data set by executing an exploratory factor analysis in SPSS. Factors that emerged for the first factor accounted for 32.46% of the variance

Table 6
Summary of inner model results.

Hypothesis	Path coefficient	t-Value	Result
H$_1$: ATT → BI	0.162**	3.073	Supported
H$_2$: SN → BI	0.068	1.373	Not supported
H$_3$: PBC → BI	0.216***	3.833	Supported
H$_4$: SI → BI	0.038	1.070	Not supported
H$_5$: EEB → BI	0.191***	3.832	Supported
H$_6$: EC → BI	0.307***	4.623	Supported

Note 1: ATT = Attitude; SN = Subjective Norm; PBC = Perceived Behavioral Control; SI = Social Impression; EEB = Environmental Ethics and Beliefs; EC = Environmental Consciousness; BI = Behavioral Intention.
Note 2: Bootstrapping Algorithm (Cases = 406; Samples = 1000).
** p-Value < 0.01
*** p-Value < 0.001.

in the measurement items. The above diagnostic analysis confirmed that there is no significant evidence to suggest the concern of common method bias in our analyzed data.

4.2. Analysis of inner model

Regarding the overall quality of the research model, we computed the Goodness of Fit (GoF) following Tenenhaus et al. [75]. The GOF is calculated as:

$$GOF = \sqrt{\overline{Communality} \times \overline{R^2}} = \sqrt{0.719 \times 0.617} = 0.667$$

According to above result, GOF is 0.667 which exceeds the cut-off criterion of 0.36 for a large effect size [76]. Thus, this research concluded the proposed model has a good overall fit and allowed us to conclude that our model performs well compared to the baseline values defined above.

Bootstrapping resampling was performed to test the significance of the path coefficients in the inner model (number of iterations: 1000). Table 6 shows the path coefficient of the inner model. If the t-value of path coefficient is bigger than 2 then confidence shows a confidence level higher than 95%, proving a strong influence in path coefficient. Of the six hypotheses proposed in this study, two did not meet the statistically significant standard: H2 (Subjective norm is positively associated with intention to use green products) and H4 (Social impression is positively associated with intention to use green products). All other hypotheses met the standard. R-square of the six exogenous constructs toward endogenous constructs was 61.7%, indicating a sufficient explanation behavioral intention.

Another means to assess the model's predictive relevance is the cross-validated redundancy (also called Q-Square). The smaller the difference between predicted and original values the greater the cross-validated redundancy (Q-Square) and thus the model's predictive accuracy [77,78]. The value of cross-validated redundancy is 0.479 are considerably above zero, which supports the model's predictive relevance for the behavioral intention towards green products usage and purchase by using blindfolding procedures [79].

5. Discussion and conclusion

5.1. Research findings

Based on the analysis of data information, the explanatory power of the model used to explain behavioral intention to use green products reached 61.7%. In this study, we explored the result of construct affecting the behavioral intention to use green products.

The survey results supported H1, that consumer attitudes about using green products have a significant positive association with the intention to use green products. Attitude is an individually introverted experience which is in other words, evaluating whether one's behavior toward a target behavior advantageous or disadvantageous cognition. When a consumer perceives that a certain behavior has favorable results, the behavior becomes even more positively and enjoyable and brings a willing mind to perform that behavior [23,80,81]. Attitude had a significant association with behavioral intention, which is consistent with theory of planned behavior and theory of reasoned action. This study showed that consumers who have a positive attitude about using green products help maintain the balance of natural ecology, improve environmental quality, reduce the cost in waste management and build the concept of environmental protection, then the intention to use green products will be firmer which then complies with Ajzen's position in 1998. According to expectancy- value model, the attitude toward different behavior depends on different beliefs and properties of behavior.

As a consequence, attitude is considered an important predictor and descriptor of behavior intention.

This study did not support H2. Expectations and pressure to use environmental products from significant others (e.g., parents, teachers, spouses and professionals) did not significantly affect the intention to use green products. As to consumers, though the expectation from significant others will cause a certain effect on using green products, the effect is not significant. Since using green products is a personal behavior based on personal opinion rather than a trend, consumers desire a clear understanding of green products. On the other hand, this study supported H3 of theory of planned behavior that perceived behavioral control significantly affects intentions to purchase and use green products. Perceived behavioral control is about the chances and the resources beliefs one has in performing a certain behavior; in other words, to feel the difficulties in certain behavior when one performs it. This can be described in two different aspects: the degree one can control in a certain when performing in a certain target behavior while the other concerns the amount of confidence one can have in it [23]. This study revealed that, as consumers increase their resources and confidence, for instance, having sufficient income to buy green products, being able to judge the correction of green mark, they increase their devotion to environmental protection, which increases their intention to use green products. This has proved that the belief in perceived behavioral control is the available resources and the number of chances one can have in performing a certain behavior [23,50,82,83].

This study did not supported H4, that consumers are not influenced significantly by public awareness of the need to use green products (e.g. improving the impression mass society lying on me, growing of my social position, have a good impression on me, satisfying my self-esteem) with no significant influence on the intention to use green products. As to consumers, social impression affected the use of green products, but the effects were not significant, probably because consumers are not highly concerned about the views of mass society. According to H5, a positive attitude about environmental cognition and concern about environmental problems have significant positive effects on the intention to use green products. Environmental consciousness is a composite concept consisting of environmental knowledge, value, attitude and love, and this concept has something to do with individual value, characteristics and other intrinsic and extrinsic factors including social and cultural ones [12]. This study confirmed that environmental consciousness has a strong impact on behavioral intention. This study revealed that consumers have a deep understanding of environmental concepts and positive attitudes and behaviors; for instance, green products are free of toxic air when being incinerated, green products should meet the properties of "recyclable materials, recyclability, low-pollution, resource saving", I always "save water, electricity and use recycled paper and do other green behavior", then a firmer intention to use green products. This study also confirmed that the environmental consciousness proposed by Schlegelmilch et al. [58] provides a better explanation of the green behavior of consumers' buying behavior degree that is a close relationship between buying behavior which has the duty on environment and the environmental consciousness.

This study supported H6, that a belief that consumers have a positive obligation and duty to protect the environment has a significant positive effect on intention to use green products. Environmentally ethics and beliefs ensure the ethical relationship between human and environment and respecting environment's belief and that belief will control one's mind, attitude and behavior. Under the traditional philosophy, the connection between human and nature is decreased by environmental destruction and degradation. The right and wrong in environment depends on the effects or the consequences caused by human; however, with the rise of deontology, researchers began to consider the human duty to protect the natural environment. This study confirmed that environmental ethics and beliefs significantly affect behavioral intention.

In this study, a stronger belief consumers have on living with environment harmoniously, for instance, human, animals and plants are all of equal importance thus respect should be shown on each other, a firmer intention to use green products. These results are consistent with Bandura [33] in social cognitive theory; an individual's belief is what can lead the behavior or the mission to complete successfully when doing a certain behavior or mission. Harvey [34] also argued a symbol of individual to real-world which can conduct one's behavior and thinking effectively.

5.2. Managerial implications, theoretical contribution and limitations

The main contribution of this study is the extension of the theory of planned behavior by including social impression, environmental consciousness, and environmental ethics with beliefs, and its applications in the analysis and prediction of behavioral intentions regarding green consumption. Environmental degradation not only affects living quality, it also depletes natural resources, which worsens the physical conditions for humans, reduces the number of species, and so on. Therefore, only we carry out environmental protection will we have a healthy body, natural ecology can be protected and society development can last sustainably; Consumption is the main cause of limited availability of resources; therefore, consumer behavior is the main cause of polluting environment. If we still ignore the importance of protecting the environment, a huge survival crisis will soon be faced. As the Taiwan economy improved, quality of life improved; however, as enjoying the economic prosperity, people in Taiwan are reconstructing a new vision of the environment to pursue a higher quality of life. In other words, more and more consumers are willing to contribute more to green products and service. Businesses must recognize that consumers want to change their consumption patterns, which means combining environmental protection into the whole industry. For instance, applying green concepts in production, packaging and marketing and would attract consumers with environmental consciousness. From the discussion on the empirical results, we could draw the following implications.

The number of consumers in this research investigation who have purchased green products at least once was high (96.1%), which indicates that a majority of consumers are already aware of the concept of environmental protection. Also in the conclusion: the social impression and subjective norm of consumers in using green products and the intention to use green products see a positive correlation but with no significant influence lying between. From this, we can conclude that the considering factors consumers have on purchasing green products are consumers' cognition of environmental protection and the comments on related products as the main one. Whether significant others and mass society have positively seen this behavior will not significantly affect the intention. Therefore, businesses must optimize segmentation and positioning to address the concerns of consumers when marketing green products in hopes of creating an effective marketing to reach the organizational goals.

Of the green products purchased by consumers, this investigation showed that recyclable products are the highest proportion and account for 80.0% while low-pollution products accounted for merely 21.1% as the lowest one. One explanation is that green products usually expensive (e.g. hybrid vehicles). As a result, officials are advised to promote and subsidize industry selling low-pollution products and people who are willing to buy them and encourage industry to produce low-pollution products in order to reach the goal of energy conservation and carbon, pollutants reduction.

The positive correlation between intention of consumers' using green products and consumers' attitude and perceived behavioral control is consistent with the results of related research. This result proved the attitude, the resource and confidence consumers have on green products will affect the intention to use green products. Therefore, businesses that can provide information about environmental

protection via electronic media or printed media and regularly hold campaigns about it can deepen consumer understanding of green products and further change their attitudes toward it and accumulate their confidence on it. As consumers gradually accept green products, businesses can achieve the goal of sustainable environment and the good publicity of them.

Consumer intention to use green products and consumers' environmental consciousness and environmental ethics and beliefs all see a positive correlation lying between and comply with the related researches' results. This has proved consumers' cognition of environmental consciousness and the view of living harmoniously with environment will affect the intention to use green products. Therefore, government officials should improve education in environmental protection and regularly hold related activities in order to explain the concerning policies of environmental protection [84]. Consumer purchases of environmentally friendly products can be increased in many ways, including promotion and management of environmental protection, encouragement of environmental awareness, proper use of natural resources to maintain the balance of natural ecology and to protect the environment, and ensuring citizens to have the responsibility on environment from social culture, will there be a possibility of increasing consumers' buying environmental friendly products.

The issue of environmental protection has been strongly emphasized. One recent trend is legislation to improve environmental protection in the international trade market. There are already some limits on investments, items or service trade that do not comply with the concept of environmental protection. Therefore, we suggest that consumers, governments and business should cooperate with each other to carry out the goal of environmental protection so that natural ecology could be protected and national sustainable development could be achieved as well.

Although our study provides useful insights, it has several limitations and further research of this study should be addressed in the future. First, this study only investigated consumer intentions to use green products based on various constructs but did not further investigate actual consumer behavior to understand the relationship between consumers' intention to use green products and consumer's actual behavior. Future studies can investigate this issue by broadening the sample to include consumers outside of Taiwan for the samples we got in this study were limited in Taiwan's consumers to understand green products' intention of consumers out of Taiwan. The second limitation is an inherent problem of a common method bias by adopting a single questionnaire to measure all constructs in this study. Although Harman one-factor testing revealed a low possibility of common method bias, a marker-variable technique should be designed whether common method bias inflated or deflated the results within the cross-sectional data. The power of the proposed model in predicting actual usage in the green products usage and purchase context may be validated further in future studies by objectively measuring usage. Finally, understanding innovations in science and technology helps consumers to understand the diversity of products and increases their purchase intentions. Innovation, in terms of commercialization is both a new product or service and a success of integrating technologies, services and multi cultures. Innovative products or services must meet the needs of consumers; that is, they must satisfy the curiosity of consumers and the need for diverse products. Therefore, existing theories of innovation can be considered to elucidate consumer intentions to use green products in future research. Recognizing the importance of this issue, further studies should attempt to extend our proposed model by incorporating potential factors and the perspicacious analysis including moderation and mediation effect examination is necessary.

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Shih-Chih Chen presently serves as an Associate Professor of Department of Accounting Information at Southern Taiwan University of Science and Technology, Taiwan. His research interests include electronic commerce, marketing, social media applications and managerial issues of emerging technologies. He has published several articles in *Technological Forecasting and Social Change*, *Computers in Human Behavior*, *Internet Research*, *Cyberpsychology Behavior and Social Networking*, *Journal of Service Management*, *International Journal of Mobile Communications*, *Sustainability*, *Journal of Medical Systems*, *Computer Standards & Interfaces*, *Industrial Management & Data Systems*, and *Human and Ecological Risk Assessment*.

Chung-Wen Hung currently serves as an Associate Professor of Department of Accounting Information at Southern Taiwan University of Science and Technology, Tainan, Taiwan. He received his Ph.D. in the Department of Finance, National Chengchi University. His research interests include Supply Chain Finance, Capital Market, Corporate Finance and Enterprise Resource Planning. He has published several articles in *International Journal of Business and Social Research*, *Journal of Financial Studies*, *Review of Quantitative Finance and Accounting*, *International Business & Economics Research Journal* and *International Journal of Productivity and Quality Management*.