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A Study on The Relationship of Smart Light Design Characteristics with Consumer Behavior

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Abstract

This study investigates the determinants of consumer purchasing intentions and the relationship between smart lamp product design and these intentions. It examines the impact of factors like social sustainability awareness, environmental sustainability awareness, perceived risk, health literacy, and product ease of use on the intention to purchase smart lights. Additionally, it explores the mediating role of altruism and the moderating effect of perceived usefulness in smart light purchasing decisions. Employing the Technology Acceptance Model (TAM) within an environmental context, the study employs a quantitative research method through surveys targeting Chinese consumers purchasing smart lights influenced by the observed variables. The findings reveal that consumers' purchase intentions for smart lights are significantly influenced by social sustainability awareness, while health literacy, perceived risk, and environmental sustainability awareness have limited impact on these intentions. Furthermore, product ease of use significantly affects consumers' intentions to buy smart lights. The mediation of perceived usefulness in the relationship between purchase intentions and social sustainability awareness is also significant. This study contributes to the literature by investigating multiple variables affecting consumer intentions towards smart lighting, offering valuable insights for practitioners in China's smart lighting market. However, its findings may not be generalized, and key elements like process and quality were not considered, suggesting future research opportunities for a broader scope and enhanced understanding.

Keywords: Social Sustainability Awareness, Environmental Sustainability Awareness, Perceived Risk, Health Literacy, Product Ease Of Use, Consumer Purchase Intention, Altruism, Perceived Usefulness, Smart Lights, China.

Introduction

China is the world's largest power consumer, consuming more than any other country. With 4,194 terawatt hours of electricity consumed in 2019, the United States came second to India as the world's greatest electricity consumer (Kandasamy et al., 2018). The average annual electricity use in China is 3,968 kilowatt-hours per person. Over the past seven years,

electricity consumption has grown 8% yearly, with a slower growth rate of 3% in 2020. In 2020, industry will account for 57% of total consumption, followed by services and housing (18 percent and 16 percent , respectively) (Karlicek et al., 2017). It significantly impacts the global energy market and the environment that China's energy demand and supply technologies are chosen. Lighting accounted for 15% of the country's total electric power generation in 1993, which was 920 billion kwh. As China's economy grows, this number is anticipated to rise, making it imperative that the country's lighting be made more energy efficient (Wang et al., 2013; Yang, 2017).

To reduce excessive light and energy being used in homes by using smart lighting in their homes is a great way to save money on your utility bills. With this functionality, you may save energy while improving the user experience. Lighting's future development will necessitate the participation of a broad range of stakeholders and groups (Shankar & Datta, 2018). Additionally, "smart lighting" encourages people to switch off the lights whenever they leave a room to reduce their dependence on artificial illumination. When a smart lighting system is in use, it can ensure that dark regions are lighted. However, little is known about the factors influencing the smart lights adoption. Based on this research gap, the following are the research gaps for the study.

- What product characteristics can determine consumer's purchasing intention?
- What is the relationship between smart lamp product design and purchasing intention?

With the huge technological advancements, the customer's behaviour and desire towards a sustainable approach has gained greater attention. The studies on smart light systems and their linkage with consumer behavior have been scarce. The increased improvement in the safety of heat emissions, enhanced energy efficiency and duplicated life spans over the conventional lights bulbs has formulated the LED bulbs to avail the sustainable lightening option, before considering the dimming capabilities (Juric & Lindenmeier, 2019). The current study has been conducted to analyse the influence and linkage between smart light design features and how customers react to it (Zipperer et al., 2013). The movement of smart light is suitable and adequate following affordability and an integral step in the appropriate direction when it comes to protecting the environment through environmental sustainability. Firstly, LEDs can be recycled and played longer than the conventional bulbs, decreasing the greater volumes of waste lightening that results in landfilling each year. The way consumer reacts towards introduction of smart lights into the market have been scarcely studied. This gives an urge to the current study to fill up the gap.

The research has numerous points of significance concerning theory and literature as well, first of all, the study has theoretical importance for adopting technology acceptance model while analyzing the impacts of social sustainability awareness, environmental sustainability awareness, perceived risk, health related literacy and product ease of use on the intention to buy smart lights by the customers. Moreover, the discussion of the mediation of altruism and perceived usefulness of smart lights purchasing between the variables, social sustainability awareness, environmental sustainability awareness, perceived risk, health related literacy and product ease of use and intention to buy smart lights is also significantly contributing towards theoretical knowledge and information and literature.

Based on the results of the study, the practitioners and experts can enhance the level of social sustainability awareness and environmental sustainability awareness of the customers, before the launch of the product, furthermore, the knowledge and information of the customers regarding health-related literacy must be enhanced as well before the launch of

the product. Furthermore, the product will be designed and produced according to the customers' opinions regarding product ease of use, for enhancing the intention to buy the smart lights positively and significantly. So, the study is significant for both the customers of the smart lights and the designers and producers of the smart lights in China.

Literature review

Theoretical Framework

Technology acceptance model has been successfully applied to a wide range of empirical studies to predict and explain acceptance and adoption of a variety of technologies such as electronic banking (Al-Smadi & science, 2012), mobile education (Tan et al., 2012) and social networks (Pinho & Soares, 2011; Shin et al., 2008), as well as to understand consumer markets for technological products and services such as online shopping (Vijayasarathy & management, 2004) and mobile shopping (e.g., Kim et al. 2009). Hsu et al. (2017) argued that green information technology products (e-books) helpful to disseminate environmental concerns that intensify the need to buy e-books to care for the natural environment, thus consumer's knowledge played an important role in UTAUT modelling to publicize environmental friendliness technology for green development. Thus, the technology acceptance model is worked in environmentalism more than the non-sustainable products, which is imperative to develop a greater attitude toward using sustainable products.

Social Sustainability Awareness And Intention To Buy Smart Lights

Nowadays, businesses are placing much more emphasis on sustainability due to stricter environmental regulations and rising pressure from stakeholders to protect the environment (Vermeir and Verbeke, 2008; Khan and Mohsin, 2017; Kumar et al., 2018; Yadav et al., 2018). Paul et al. (2016) suggested motivating consumption of green products among customers to attain sustainability. In order to promote such products, sellers need to understand consumer preferences and decision-making process in the context of green products (Cherrier et al., 2011). Moreover, fluctuating preferences of environmentally cautious customer has made it difficult for marketers to sell green products (Kilbourne and Pickett, 2008; Ha and Janda, 2012). Much of the existing literature in this area refers to the framework of theories of cognitive behaviour to explore antecedents of consumers' environmental behaviour. Consumers' knowledge of environmental matters positively correlates to pro-environmental behaviour (Prakash and Pathak, 2017). Some behaviors, such as buying eco-friendly apparel or recycling clothing, can be sustainable behavior because those behaviors directly or indirectly affect the environment. Consumer behavior is the customer's evaluation of positive or negative implications of applying a product / service (Ajzen & Fishbein, 1975; Nguyen, Nguyen, Dang, & Nguyen, 2016; Nguyen, Nguyen, & Vo, 2019; Phan, Nguyen, & Bui, 2019). Customers with a positive attitude about the service will increase their intention to use it (Davis, 1989; Xu et al., 2020).

H1: Social sustainability awareness significantly impacts the intention to buy smart lights.

Environmental Sustainability Awareness And Intention To Buy Smart Lights

Excessive use of natural resources has consequences for the environment, so environmental issues have become a global concern (Chen, Huang, Wang, & Chen, 2020; Kumar, Luthra, Khandelwal, Mehta, Chaudhary, & Bhatia, 2017). Green consumption is considered a behavior to help protect the environment (Mostafa, 2006), in which green consumers always pay attention to environmental protection, use of pollution reduction products / services,

responsible use of natural resources, and recyclable products after use. Consumers are increasingly aware that their consumption activities have caused bad impacts on the environment and they are always inclined to consume green. in their consumption decisions. (Choi & Johnson, 2019; Kumar et al., 2017; Mostafa, 2006). There have been many studies on green consumption behavior and customers' intention to purchase green products. Among the factors influencing intention to use, studies all use attitudes towards green consumption behavior as in the classic studies on intentions of behavior (Ajzen, 1985; Choi & Johnson, 2019; Panda et al., 2020; Xu et al., 2020) Consumer behavior is the customer's evaluation of positive or negative implications of applying a product / service (Ajzen & Fishbein, 1975; Nguyen, Nguyen, Dang, & Nguyen, 2016; Nguyen, Nguyen, & Vo, 2019; Phan, Nguyen, & Bui, 2019). Customers with a positive attitude about the service will increase their intention to use it (Davis, 1989; Xu et al., 2020). Environment concern also plays a significant role because the consumers considered buying organic food as environment-friendly behavior (Smith & Paladino, 2010). This study proposes that environmental knowledge and awareness are significant predictors of students' attitudes to the environment, and posits the following hypotheses for empirical testing:
H2: Environmental sustainability awareness significantly impacts the intention to buy smart lights.

Perceived Risk And Intention To Buy Smart Lights

Chen and Chang (2013b) described green perceived risk as believing that buying activity would negatively impact the environment. In addition to its impact on consumers' uncertainty and suspicion, misleading, vague and inaccurate green advertising may trigger the customer to develop a sense of danger compared to consuming goods. The potential consequences of an improper judgment are thus associated with a green perceived risk (Aji & Sutikno, 2015). The perceived risk is not only linked with the environment itself, but also the physical body of the consumer from the perspective of negative perceptions. A mixture of potential outcomes and ambiguity is a perceived risk. Accordingly, the perceived risk would affect a consumer's purchasing decision (Chen & Chang, 2012). It would also affect the attitudes of consumers. In some ways, the risk confronting customers is observed and felt stronger than the advantages they obtain. This perspective is consistent with the idea that consumers want to reduce perceived risk instead of maximizing usefulness (Aji & Sutikno, 2015).
H3: Perceived risk significantly impacts the intention to buy smart lights.

Health Literacy and Intention To Buy Smart Lights

Health knowledge is highly important for coping with and preventing chronic problems. Simply put, knowledge of health is related to health behavior (Gellert et al., 2016). Yin et al. (2010) found that health benefits, like health development and preservation, are the dominant motivators for green consumption. Purchase intention refers to the evaluation or attitude of consumers to the related products, with the stimulation of the external factors, constitutes a consumer's willingness to buy. While consumers are willing to buy some production, the higher purchase intention, the greater the probability of purchase (Dodds, Monroe & Grewal, 1991). Consumer buying behavior can usually predict from their wishes (Bai, Law & Wen, 2008). Basis Zeithaml, Berry & Parasuraman (1996) also agreed that the willingness to buy is a behavioral intention, although the willingness to buy is not the same as buying behavior occurred. However, it is no doubt that consumers usually based on their own experience and search for relevant information to assess by comparison and judgment before

arising from the purchase behavior. In other words, the personal willingness to buy green product is likely to be consideration of health reasons and the level of interest in environmental values.
H4: Health literacy significantly impacts the intention to buy smart lights.

Product Ease Of Use And Intention To Buy Smart Lights

The PEOU construct has been used in various contexts such as electronic mail, e-commerce, m-commerce and intention to use internet applications (Akman & Mishra, 2015; Hawryluck et al., 2004; Lee et al., 2011; Mathieson, 1991; Vijayasarathy & management, 2004). Kim and Song (2012) propose that perceived usefulness is related to purchase attitude among online shoppers. If consumers find an e-commerce website useful for shopping, they will advantageously have a better e-purchasing attitude. Other studies by Yoon and Steege (2005), Punnoose (2011), Aldás-Manzano et al. (2012), Özbeka et al. (2010) and Devaraj (2017) also confirm the relationship between PU and INT. Several researchers have found a positive relation between the PEOU and INT. Childers et al. (2015) suggest that clear and understandable online shopping sites, which require fewer mental efforts of their users to make a purchase, are more attractive for potential customers than more complicated ones. Here, perceived ease of use is recognized as the extent to which people feel ease or not when using a product. New technology is applied to energy-efficient appliances, which makes them different from common household appliances. Some consumers may get confused about such technological innovation, think the products are hard to use, and tend to not use them. Recognizing whether an item is easy to operate will affect consumers' intention to own it.
H5: Product ease of use significantly impacts the intention to buy smart lights.

Mediation Of Altruism

Consumers with higher levels of altruism are more cautious about the ecological benefits of their behaviour than the consequences for themselves (Steg et al., 2014). Therefore, this group of consumers are more conscious about the environment. In the wake of past research (Guéguen and Stefan, 2016; Yadav and Pathak, 2016), the findings show that altruism significantly affects customers' green purchase intentions. According to Teng et al. (2015), an individual's sense of what is right and ethically right to do is composed of personal norms that belong to a deliberate commitment that individuals feel in making the best choice, irrespective of what others think. Altruistic values include the demonstration of accomplishing something good for others without anticipating anything (Teng et al., 2015). Different factors are found to impact consumers' intention to buy eco-friendly products (or in this case smart lights). The concern of the consumers for the environment shows their selflessness towards the betterment of the environment and the Earth leading to Altruism (Dwivedia et al., 2021). The product's ease of use is also considered while designing an eco-friendly product. The sensitiveness of the consumers towards the environment also plays an important role in selling these products. However, Altruism is considered to mediate between the product ease of use and the consumer's intention to buy the environment friendly products.
H6: Altruism mediates the relationship between social sustainability awareness and intention to buy smart lights.
H7: Altruism mediates the relationship between environmental sustainability awareness and intention to buy smart lights.

H8: Altruism mediates the relationship between perceived risk and intention to buy smart lights.
H9: Altruism mediates the relationship between health literacy and intention to buy smart lights.
H10: Altruism mediates the relationship between product ease of use and intention to buy smart lights.
H11: Perceived usefulness of smart lights purchasing mediates the relationship between social sustainability awareness and intention to buy smart lights.

Mediation of perceived usefulness

The perceived usefulness plays a very important role in the product ease of use. It also has an impact on the intention of the consumers in buying of the products. The smart lights consumption plays an important role in delivering better health to the consumers as well as the pollution rate is also found to be decreasing with increasing consumption of smart lights (Hasan et al., 2018). It has been observed that different parameters highly influence consumers' intention to buy smart lights or any other technological devices. The compatibility and usefulness of the objects plays an important role in influencing the consumers positively in buying certain products. Whereas, the perceived risk as per the risk theory might have a negative impact on the consumers and may find it a risk taking decision (Blut et al., 2016). But the product ease of use can also be determined so that the consumers could be encouraged to buy the products. A study observed that the people who perceived the usefulness of the smart green products, were more drawn towards buying them irrespective of any economy sensitivity or other issue as they were well aware of the environmental sustainability. They want to contribute towards it without hesitation so that future generations can enjoy the natural resources we are using today (Lanlan et al., 2019).
H12: Perceived usefulness of smart lights purchasing mediates the relationship between environmental sustainability awareness and intention to buy smart lights.
H13: Perceived usefulness of smart lights purchasing mediates the relationship between perceived risk and intention to buy smart lights.
H14: Perceived usefulness of smart lights purchasing mediates the relationship between health literacy and intention to buy smart lights.
H15: Perceived usefulness of smart lights purchasing mediates the relationship between product ease of use and intention to buy smart lights.

Method

Sampling Strategy and Data collection

Since this study is based on the quantitative research design, the survey strategy was used for data collection. The researcher has selected this specific method as it involves completion of the survey by the respondent without any kind of intervention or assistance of the researcher, so, the responses will completely be a result of unbiased opinion of the participants, rather than a result of the intervention and personal opinion of the researcher (Radhakrishna, 2007; Rowley, 2014). So, as a result of this, the researcher will become able to collect data regarding the intentions of the Chinese consumers to buy smart lights under the influence of social sustainability awareness, environmental sustainability awareness, perceived risk, health related literacy, product ease of use, altruism and perceived usefulness of the product. For this specific research, close ended questions are added into the questionnaire, meaning there are specific responses, from which the participants can select the response for each question

(Aborisade, 2013). The data was collected from the consumers of China's green or sustainable products. The non-probability technique of convenience sampling will be used in the study. The technique will be used to reach out to the primary focused participants for this research according to the objectives. Then the participants will be screened on the basis of willingness to take part in the research and on the availability for this specific research (Etikan, Alkassim, et al., 2016; Etikan & Bala, 2017). After this step, screening or selection will be done based on the purpose of judgment sampling technique, following which, the participants will be taken out for the sample on a very selective basis. The participants will be judged according to the objectives of the research, the variables under study and the research questions that the researcher is addressing in this study (Etikan, Musa, et al., 2016; Frankel et al., 2012; Lamm & Lamm, 2019). So, after following both methods, only those participants are considered as the sample that are the basic consumers of the sustainable products, to measure the level of intention to buy smart lights among such consumers in China (Bauer, 2014).

Measurement Items

Independent Variables

For Social Sustainability Awareness 6 measures are adopted from the study of (Panda et al., 2020), and similar measures are also significantly considered and adopted by the studies of (Hamid et al., 2017; Hussain et al., 2018). These involve sample item, "I am aware that organizations must be careful about implementing social practices." For Environmental Sustainability Awareness 6 measures are adopted from the study of (Panda et al., 2020), and similar measures are also significantly considered and adopted by the studies of (Awan & Abbasi, 2013; Hamid et al., 2017). These involve sample item, "I am aware of the environmental changes the world is going through". For perceived risk, 5 measures are adopted from the study of (Rizwan et al., 2013), and similar measures are also significantly considered and adopted by the studies of (Ariffin et al., 2018; Ling et al., 2011). Sample item involves "There is a chance that there will be something wrong with environmental performance of this product". For Health-Related Literacy, 4 measures are adopted from the study of (Photcharoen et al., 2020), and similar measures are also significantly considered and adopted by the studies of (Choi et al., 2021; Lachance et al., 2010). These include sample item, "I know organic products are good for health" and "I have good health knowledge to take care my health". For Product Ease of Use, 3 measures are adopted from the study of (Moslehpour et al., 2018), and similar measures are also significantly considered and adopted by the studies of (Cho & Sagynov, 2015; Sin et al., 2012).

Mediating variables

For Altruism, 5 measures are adopted from the study of (Panda et al., 2020), and similar measures are also significantly considered and adopted by the studies of (Baek et al., 2020; Iyer et al., 2016). These include sample item, "If needed, I am ready to show my willingness to help others". For Perceived Usefulness of Purchasing, 3 measures are adopted from the study of (Moslehpour et al., 2018), and similar measures are also significantly considered and adopted by the studies of (Hussain et al., 2018; Iyer et al., 2016).

Dependent Variable

For Intention to Buy Smart Lights 7 measures are adopted from the study of (Panda et al., 2020), and similar measures are also significantly considered and adopted by the studies of (Hussain et al., 2018; Iyer et al., 2016).

Data Analysis

This study used SPSS to perform a descriptive analysis, followed by structural equation modelling partial least square (SEM- PLS) approach, which was employed to test the research model. SEM-PLS has been recognized as a prominent statistical technique in various disciplines, including marketing (Hair et al., 2012) and consumer behaviour research (Henseler et al., 2009). It focuses on explaining variances, thus making it a prediction-oriented approach capable of predicting the phenomenon of interest (Shmueli et al., 2019).

Results

Descriptive Statistics

As a part of the initial analysis, descriptive statistics were calculated. It can be seen in the table below that all the variables have a total of 343 values which indicates that there is no issue of missing data in the current sample. In terms of mean, HL holds the highest mean with a value of 4.22. ALT has a mean of 4.12 followed by ITB and PU with an estimated mean of 4.11. ES was found to have a mean value of 4.09 whereas SSA had a mean of 4.07 as shown in the table. The mean of PEU was also close to 4 as the value is 4.01. PR was found to have the lowest mean among all the variables with a value of 3.56. For verifying normal univariate distribution, criteria for skewness and kurtosis were utilized. It has been stated that kurtosis values must be between +7 and -7 (Hair et al., 2010). For assessing the asymmetry of the data, the recommended range falls between +2 and -2 (Byrne, 2016; Hair et al., 2010). It can be confirmed that no variable has a kurtosis value higher than 7 and similarly, all the variables met the criteria for skewness. Hence, no outliers and univariate normality of the data has been established.

Table 1
Descriptive Summary

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
PU	343	2.00	4.67	4.1059	.41117	-1.132	.132	2.776	.263
PEU	343	2.00	4.67	4.0126	.45474	-1.250	.132	2.461	.263
ES	343	2.17	4.83	4.0962	.35933	-1.134	.132	3.049	.263
SSA	343	2.00	4.75	4.0656	.42715	-1.157	.132	2.346	.263
PR	343	1.50	4.67	3.5564	.96439	-1.024	.132	-.438	.263
ITB	343	1.67	5.00	4.1069	.42529	-1.375	.132	3.781	.263
ALT	343	2.00	5.00	4.1224	.47866	-.789	.132	.780	.263
HL	343	2.20	4.80	4.2227	.35220	-1.599	.132	4.413	.263
Valid N (listwise)	343								

PU= Perceived usefulness, PEU= Product ease of use, ES= Environmental sustainability, SSA= Social sustainability awareness, PR= Perceived risk, ITB= Intention to buy, ALT= Altruism, HL= Health literacy

Sampling Adequacy

For factor analysis, confirming that the data is suitable and appropriate for detecting factors (Tabachnick & Fidell, 2007). To verify the sample suitability, two measures were employed by the researcher. Bartlett's test of sphericity was used along with Kaiser-Meyer-Olkin (KMO) and both measures are widely adopted in research concerning factor analysis (Moslehpour et al., 2018; Shrestha, 2021). A standard range of KMO has been determined where values below 0.6 are considered inadequate and insufficient for factor analysis. Values above 0.6 but below 0.8 demonstrate that the sampling is commendation and acceptable. Lastly, values between the range of 0.8 and 1 show that sampling is adequate (Tabachnick & Fidell, 2007). The test results are displayed in the table below. With a value of 0.795, the researcher established with the KMO test that the sampling is acceptable as it falls within the acceptable range. Similarly, by observing Bartlett's test significance value, the suitability of data was verified as the significance level was below 0.05. The researcher established the suitability and adequacy of the data and proceeded with the factor analysis.

Table 2
Sample Adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.795
Bartlett's Test of Sphericity	Approx. Chi-Square	3826.725
	df	496
	Sig.	.000

Rotated component matrix

The table shows the factor loadings for each construct's items using the commonly used adjustment method, known as varimax rotation (Costello & Osborne, 2005). As per the rule of no cross-loadings, it can be deduced that all items utilized to measure the specific construct solely represent their distinct factors and all the values are greater than the assigned threshold (Tabachnick et al., 2013).

Table 3
Outer Loadings Of The Measurement Model

	ALT	ES	HEALTH	ITB	PEU	PR	PU	SSA
Altruism 1	0.69							
Altruism 2	0.66							
ES1		0.453						
ES2		0.729						
ES4		0.507						
ES5		0.55						
ES6		0.565						
HL1			0.508					
HL2			0.389					
HL3			0.538					
HL4			0.717					
ITB2				0.645				
ITB3				0.691				
ItB1				0.498				
PEU1					0.618			
PEU2					0.623			
PEU3					0.572			
PR1						0.744		
PR2						0.799		
PR3						0.84		
PR4						0.896		
PR5						0.749		
PR6						0.896		
PU2							0.748	
PU3							0.758	
SSA1								0.571
SSA2								0.498
SSA3								0.617
SSA4								0.652

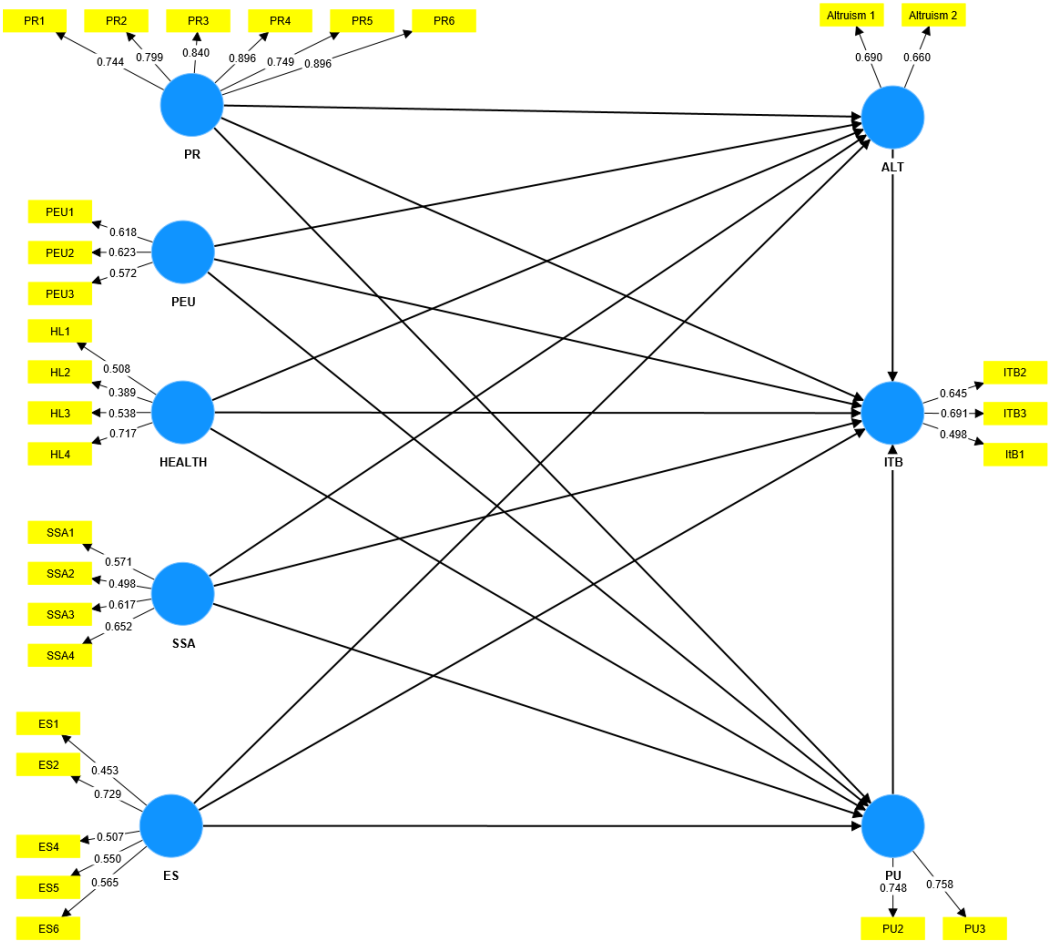

Figure 1: Re-specified measurement model

Reliability & Construct Validity

The concept of validity in quantitative research refers to how well a concept is being measured. Two measures of construct validity are frequently used, namely convergent and discriminant validity (Hair et al., 2020). To evaluate convergence, the researcher assessed composite reliability (CR) values and average extracted variance (AVE) for each variable. CR is a widely used indicator in research that aids in testing the validity of constructs. The results of construct validity tests are presented in the table below. For CR, a standard benchmark has been set to a value higher than 0.7 as previously suggested by scholars (Hair et al., 2010). It has been stated that values that exceed 0.7 by a larger margin indicate a higher reliability level. The table values below indicate that the levels of reliability and validity for the constructs are low, suggesting some issues with the model's fitness. However, a larger sample size can be used to eradicate these issues.

Table 4:
Construct Reliability and Validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
ALT	-0.193	-0.193	0.626	0.456
ES	0.472	0.489	0.699	0.323
HETR	0.198	0.216	0.624	0.303
ITB	0.177	0.19	0.644	0.381
PEU	0.134	0.135	0.634	0.366
PR	0.918	0.958	0.926	0.677
PU	0.237	0.237	0.724	0.567
SSA	0.362	0.365	0.676	0.345

PU= Perceived usefulness, PEU= Product ease of use, ES= Environmental sustainability, SSA= Social sustainability awareness, PR= Perceived risk, ITB= Intention to buy, HETR= Health literacy

Along with convergent validity, the other concept associated with validity in research is to evaluate whether concepts presumed to be distinct are truly different (Hair et al., 2010). Therefore, the researcher relied on the "Fornell-Larcker" principle to analyze the degree of difference among constructs. This has been commonly utilized in research. The criterion postulates that the square root of AVE has to exceed the correlation with other latent constructs (Hair et al., 2014). To assess whether the constructs met the requirements, the diagonal values that are in bold are compared to the off-diagonal values. While a few variables met the required benchmark for discriminant validity, the researcher cannot fully establish construct validity as issues in both validity tests exist. The lack of convergence can be due to the inability of the scale to measure the presumed construct and a lack of correlation among the questionnaire scores (McGrath, 2005). In addition, scholars have discussed that subject or response bias and construct confounding can be potential reasons for lower construct validity (Brewer & Crano, 2000). Low construct validity can be tackled by reconstructing items in future research (Henseler et al., 2015).

Table 5
Discriminant Validity

	ALT	ES	HETR	ITB	PEU	PR	PU	SSA
ALT	**0.675**							
ES	0.606	**0.568**						
HETR	0.456	0.564	**0.551**					
ITB	0.431	0.524	0.481	**0.617**				
PEU	0.425	0.525	0.475	0.482	**0.605**			
PR	0.055	0.061	0.208	-0.006	0.057	**0.823**		
PU	0.453	0.478	0.453	0.508	0.431	0.062	**0.753**	
SSA	0.606	0.634	0.601	0.639	0.486	0.114	0.535	**0.587**

PU= Perceived usefulness, PEU= Product ease of use, ES= Environmental sustainability, SSA= Social sustainability awareness, PR= Perceived risk, ITB= Intention to buy, HETR= Health literacy

Model fitness

Once the reliability and validity of the model was tested and insignificant items (items with outer loadings less than 0.4) were removed from the model, the researcher evaluated its fitness. The threshold value for SRMR is 0.08, and for NFI it is reportedly 0.8. The values in table 6 indicate that neither criterion was satisfied and thus, the model wasn't fit. The lack of convergent and discriminant validity also supports this. The fitness and validity of the model can be improved via increased sample size and usage of different scales for quantification of the data as the reliability values were also very low.

Table 6:
Model Fitness

	Saturated model	Estimated model
SRMR	0.101	0.101
d_ULS	4.4	4.405
d_G	1.089	1.091
Chi-square	2011.939	2014.176
NFI	0.434	0.434

Hypotheses Testing

Table 7 presents the results from the hypotheses testing, and the findings for both direct and indirect path analysis has been represented in the table. The findings indicate that a unit increase in the perceived ease of use of the smart bulbs would increase the customer intention to buy by 17.5% as $t>1.96$ and $p<0.05$. Similarly, a unit increase in the perceived risks would decrease the intention to purchase the smart books of the Chinese consumers by 9.3%, as $p<0.1$. The table also indicates that the unit increase in social sustainability awareness would increase Chinese consumers' intention to buy smart bulbs by 44.6%. Only these three direct associations were found to be significant, and the remainder of the two determinants that is help to see and environmental sustainability were found to be insignificant.

Table 7:
Hypotheses Testing

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
ES -> ITB	0.099	0.105	0.072	1.383	0.167
HEALTH -> ITB	0.093	0.091	0.069	1.346	0.178
PEU -> ITB	0.175	0.173	0.072	2.444	0.015
PR -> ITB	-0.093	-0.082	0.055	1.696	0.09
SSA -> ITB	0.446	0.441	0.073	6.074	0
HEALTH -> PU -> ITB	0.022	0.022	0.014	1.486	0.137
HEALTH -> ALT -> ITB	-0.001	-0.001	0.006	0.221	0.825
ES -> ALT -> ITB	-0.014	-0.016	0.026	0.552	0.581
SSA -> ALT -> ITB	-0.014	-0.015	0.025	0.583	0.56
PR -> PU -> ITB	-0.002	-0.003	0.011	0.214	0.831
PEU -> ALT -> ITB	-0.003	-0.004	0.008	0.373	0.709
PEU -> PU -> ITB	0.027	0.027	0.016	1.641	0.101
PR -> ALT -> ITB	0.001	0.001	0.005	0.126	0.9
ES -> PU -> ITB	0.023	0.026	0.019	1.192	0.233
SSA -> PU -> ITB	0.052	0.05	0.024	2.179	0.029

The mediation effects of altruism and perceived usefulness were evaluated in the next testing phase. Table 7 indicates that the mediation of perceived. Usefulness between perceived ease of use and intention to buy and between social sustainability, awareness and intention to buy was positive and significant. These findings suggest that altruism did not significantly model mediate the associations between consumer purchase factors and intention to buy. Whereas perceived usefulness of the product mediated two of the five proposed associations. Thus, only five of the fifteen hypotheses were accepted as shown in the table 7.

Discussion of the findings

The study has conducted to explore the relationship of smart light design characteristics with consumer behaviour in China. In the global marketplace, businesses and industries are rapidly expanding, causing the depletion of natural resources; therefore, businesses must be sustainable and preserve natural resources (Khan et al., 2021). Consumers are becoming well aware of environmental changes, and they want businesses to be accountable towards their sustainability and environmental protection practices and their impact on the society and environment in which they operate (Dong et al., 2021). The changing environmental patterns significantly influenced consumer behaviours and purchasing intentions (Qi & Ploeger, 2021). The present study has analysed the concept of social sustainability and its impact on businesses and consumers.

According to Moghavvemi et al. (2020), adopting smart lights is largely dependent on and is shaped by consumer behaviour. Businesses must understand consumer behaviour and the factors influencing them to be aware of the benefits of using smart lights. Environmental preservation and energy conservation are rising global issues and are receiving widespread global attention (Zhao et al., 2022). Several global environmental challenges have been propagated by undesirable human behaviour. These challenges include a rise in the sea levels, melting high amounts of snow and ice, causing the atmosphere and oceans to become

warmer; consumption of fossil fuels has also been increased to a great extent which results in a higher concentration of emission of greenhouse gas, depletion of natural resources and climatic changes and biodiversity loses with significant harms to humankind and animals as well (Moghavvemi et al., 2020). Consumers' growing concern about the environment has increased their search towards green products that are not harmful to the environment. The demand for green products and sustainable offerings can be attributed to their increased environmental sustainability awareness. Environmental sustainability is now given even more attention and importance than ever before because it concerns how individuals can attain natural resources, clean air and water, healthy communities and improved overall quality of life. In the view of Ibnou-Laaroussi et al. (2020), consumers' intention to purchase green and sustainable products is significantly evident when they have a higher level of awareness regarding environmental sustainability.

Organic and green products are considered supportive factors of healthy lifestyles. The execution of the factual knowledge design and the detailed mannerism of timing is referred to as procedural health knowledge. Health literacy is crucial in preventing and coping with chronic problems (Okan et al., 2020). According to Sentell et al. (2020), a person's health literacy is related to his health behaviours. According to the study of Thomas-Walters et al. (2021), the health advantages such as health preservation and development are the significant motivators for the consumption of green products. Therefore, consumers who are conscious about their health and have health literacy are more likely to purchase green products such as smart lights and lamps.

In the view of Guiao and Lacap (2022), although altruism is directly associated with environmental sustainability, however, it has been observed that individuals who are aware of sustainability and environmental concerns are found to be not automatically altruistic. This also can be attributed to the circumstances where people care about their environment only because environmental issues can worsen their quality of life. However, consumers' awareness of environmental sustainability is more apparent today than in the past because they are more committed to protecting the environment and conserving natural resources from depletion (Olalekan et al., 2019). According to the findings of the study by Li et al. (2020), the environmental sustainability awareness of a consumer is positively and significantly associated with altruism. Furthermore, Panda et al. (2020) has argued that the level of awareness of a consumer about environmental sustainability also predicts consumers' altruism.

Conclusion

The study evaluated the factors influencing buying intentions for smart lights, specifically exploring the role of altruism and perceived usefulness as mediating variables. The findings from this study indicated that the consumer’s intention to purchase smart lights are influenced by social sustainability awareness, suggesting that socially conscious individuals are more likely to buy these products. However, environmental sustainability, perceived risk and health literacy didn’t influence buying intentions. The study also highlighted the role of product ease of use in driving buying intentions. The meditation of perceived usefulness between social sustainability and buying intentions was also significant, indicating that consumers are more inclined to purchase smart lights if they believe the products will help them achieve social sustainability goals.

Implications of the study

This study is theoretically extremely significant and vital since it has included several essential factors used separately in earlier studies across time (Föhr, 2022; Heqi & Halabi, 2023). The current study offers several benefits for both literary and real-world applications. Investigating the role of altruism in mediating the relationship between the purchase of smart lights and several independent factors, including social sustainability awareness, environmental sustainability awareness, and health-related literacy, makes a major contribution to theoretical understanding. The study provides practical value for specialists and practitioners examining Chinese consumers' awareness of social and environmental sustainability, health-related literacy, and smart light purchase trends. This knowledge can help with product development and design to meet consumer needs. This study's findings can help experts and practitioners create policies that raise consumer social and environmental sustainability awareness and health literacy.

Limitations and Recommendations

There are various limitations to the current study. Because this study was conducted in China, its applicability to other cultural settings may be constrained. The results of this study might not be relevant to other areas or cultures since consumer behavior and attitudes toward sustainability may differ across various nations. Therefore, care should be used when attempting to extend the findings of this study to other situations because they could only apply to the context of China. Only the link between the design elements of smart lights and consumer perceptions of sustainable products was the subject of the study. Other elements including price, brand reputation, and product quality that may affect customers' purchase decisions were not considered. As a result, the findings might not be able to completely account for customer intentions and conduct about smart lighting. Only consumer self-reported data, which may be biased and vulnerable to social desirability effects, were employed in the study. Instead, of expressing their genuine ideas, participants could have given responses they thought were expected or socially acceptable. The study's findings thus could not precisely represent customers' real intentions and conduct. This study only offered a picture of the association between factors at a specific time since it used cross-sectional data. Longitudinal research may offer more reliable proof of the causal relationship between the features of smart light design and customer behavior. The study's small sample size may constrain the results' generalizability. The sample size could not have accounted for all relevant variables or identified small but significant modifications in consumer behavior.

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