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Influences of Green Lighting System in Shopping Center on Customer Experience: Evidences from AEON Mall Long Bien in Vietnam

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Abstract

The study's objective is to assess the influence of the green lighting system in the shopping center (AEON Mall Long Bien) on customer experience by testing Structural Equation Model through software SPSS and AMOS. The study was completed based on survey results of 313 observations and combined with interview results obtained from department heads, deputy heads, and departmental staff directly involved in the building management system and the lighting control system. The results show that the green lighting system has a positive influence on customer experience through the following factors of customer experience: Sensorial dimension, Affective dimension, Cognitive dimension, Behavioral dimension, Social dimension.The research's results imply that rational use of green lighting will bring positive impacts to customer experience, thereby positively influencing the revenue of shopping centers, so shopping centers need to further enhance the green lighting system implementation effectively.

Keywords: Green lighting system, customer experience, shopping center, AEON Mall

1. INTRODUCTION

Nowadays, lighting system is not only used for the original purpose of providing light but it also serves consumers with aesthetic elements. For that reason, light is an indispensable factor in the development of retailers, shopping malls, and entertainment business in Vietnam and abroad. Every type of businesses goes with a suitable type of lighting and it can be concluded that lighting is one of the potential factors that retailers can use to satisfy their customer experience. Over the years, Vietnam has seen significant improvements in lighting technology (*Doan Chien Thang*, 2018). Despite its potential and versatility, how to use the light in a way that can save power, suit the economic situation and achieve environmentally friendly standards is still a big question that needs to be explored, especially in the current situation of light pollution in Vietnam. In the past, there has been a considerable amount of technical research and analysis on the level of power, color as well as some basic parameters of lighting systems affecting the purchasing power of consumers. However, these topics are mostly studied in countries that are on top in the retail industries such as Europe, America and Japan. However, in a country where the retail industry is on the rise like Viet Nam, the number of topics on lighting systems is still limited. On the other hand, most of the research on this topic has not focused on environmental protection factors but only focused on economic benefits, mainly aiming to increase profits for businesses. Therefore, the

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integration of "green", sustainable, and environmentally friendly factors in the development of lighting systems is still a new issue that needs to be studied and expanded.

Moreover, the solutions proposed from the previous researches on lighting systems are only aimed at businesses' benefits, therefore, the feelings of customers themselves still need to dig deeper. The customer's shopping experience is also considered one of the important factors, contributing to the development of the retail system (*Bruce Delteil, Matthieu Francois, Duy Mai, and Jeongmin Seong*, 2019). However, the researches on the factors that affect the customer experience of a shopping mall have mostly been limited to a few common factors including products, packaging, attitude, and employee behavior. When it comes to the lighting system, it is only considered as a small aspect of a certain element of the shopping environment. Combining two novel terms "green" elements in the lighting system and the customer's shopping experience, this research aims to find answers for the questions: The effects of green lighting system to customer experience. The benefits that green lighting system brings to consumers and the level of consumers' satisfaction under the influence of the green lighting system, thereby finding solutions to boost revenue and increase benefits for shopping malls.

To answer these questions, the authors conducted a study and analysis on the influence of the green lighting system in the shopping center (AEON Mall Long Bien) on the shopping experience of consumers. The article is divided into 5 parts: (i) Introduction, (ii) Research overview and theoretical basis, (iii) Research methodology, (iv) Research results and discussion, (v) Conclusion.

2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1. Literature overview

Beginning in the early 2000s, research on lighting system started to attract a lot of attention. And it can be seen that almost research at this time focused mainly on the evaluation of the technical efficiency, parameters, brightness, and appropriate illuminance of the lighting system. Dang Mau Chien (2009) conducted research of the technical efficiency between conventional lighting systems and LED systems using solar energy in terms of parameters: brightness, uniformity, and the durability of the equipment; at the same time, evaluating the economic efficiency achieved. The research's results show that LED lights using solar energy are slightly better than conventional LEDs in certain factors. Around that time in the world, it also appeared a considerable number of researches on lighting systems connected with a commercial purpose, focusing mainly on proposing solutions to help optimize the energy use of lighting systems (*Sofia Stensson, Monica Axell, Per Fahlén, Jörgen Eriksson and Simon Roos*, 2009).

Since 2010, there have been several types of research on lighting systems associated with business, such as the authors Zhang Yan, Chaipoopirutana Sirion, Combs Howard (2011) researched the influence of environmental factors in the mall, including the level of influence

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of lighting system on purchasing value and consumer behavior. Through testing the hypotheses, it was found that the space in the shopping center including the lighting has influenced consumers' perception of the value of goods, thereby influencing the consumer's responses. The authors J. Deepika, and T. Neeraja (2014) carried out the topic of the influence of light on the behavior and shopping experience of customers in a retail store. Research shows that lighting is not an influencing factor to a large extent on consumers' shopping decisions, timing, level of payment for a store as well as customer experience. However, that does not mean that lighting does not affect customer behavior and experience, it still affects but to a moderate extent. Otherwise, in Vietnam, the concept of a green lighting system is still very unclear and modern, the number of research words is quite small and only focuses on the profits that businesses can take advantage from the lighting system and do not pay much attention about how the lighting system can affect the feelings of consumers. For example, the authors Nguyen Tien Dung, Nguyen Minh Tam, Pham Ngoc Thuy (2017) researched the influences affecting the purchasing decision of consumers at a shopping mall, in which the lighting system is mentioned as a branch of the variable "internal environment" among many other variables given in the research paper and not yet considered as an independent variable. Moreover, author Nguyen Thi My (2019) researches factors affecting customers' shopping experience at Co.opmart Hue supermarket. The customer experience at the supermarket has been measured through the criteria of Demand, Price policy, Availability, Convenience, Service/Support, Quality, Fashionability/Aesthetics, Infrastructure, and Social Responsibility. In which, the lighting system is only mentioned as a small part of the infrastructure indicator affecting the customer's shopping experience.

From the inheritance of the achievements of previous studies and based on research gaps, the authors have proposed a research direction on The influence of the green lighting system on customer experience through building a model, which assesses the influence of the green lighting system based on the following factors of customer experience: Sensorial dimension, Affective dimension, Cognitive dimension, Behavioral dimension, Social dimension.

2.2. Theoretical framework

2.2.1 Green lighting system

It is estimated that the amount of electricity used for lighting accounts for 20-40% of the total electricity used in buildings, only after the air conditioning system, and it accounts for 30%-35% of the building's operating costs (*Pham Duc Nguyen*, 2014). Moreover, the task of designing the lighting system is often assigned to the contractors while these contractors have little understanding of energy-saving issues. This situation requires buildings to have an optimally designed lighting system with high efficiency to reduce electricity consumption for lighting. Therefore, a new concept was born named: The green lighting system.

A green lighting system is a system in which a high-quality, environmentally friendly light source is used, providing great overall efficiency, and at the same time helping to save electricity (*Huynh Kim Tuoc*, 2012). Moreover, in order to ensure those standards, this system

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must be designed in a reasonable, efficient and scientific ways, and at the same time meet the standards and regulations on lighting, creating a good lighting environment, therefore, improving quality of life.

Green lighting system also plays a certain role. Firstly, green lighting system helps to connect the community. Secondly, green lighting system brings balance for buldings. Thirdly, the green lighting system enhances the personal customer experience. Fourthly, green lighting system enhances cost-effectiveness. Fifthly, green lighting system protects human health. Careful use of materials can reduce energy consumption during production, protecting the health of building or building occupants. Sustainable construction techniques can reduce the amount of construction waste that ends up in landfills by 95% or more.

It can be seen that the role of green lighting in our lives is extremely important. Using an efficient and economical lighting system can reduce electricity consumption, save costs, reduce pressure on the community, and further reduce greenhouse gas emissions and other dangerous risks for the environment.

2.2.2. Customer experience

Customer experience (CX) refers to the cognitive and emotional index that customers have for a service due to the influence and accumulation from their interactions with different kinds of service (*Gartner*, 2017)

Referred to as a customer's emotional state, thoughts and impressions about a firm based on the service they receive, customer experience is an emotional feeling that can change either positively or negatively over time depending on various factors. When it comes to customer interaction, it means: a long-term, continuous interaction provided by the company to the customer, with the consent of the customer (*Paul Greenberg*, 2002).

Customer experience also plays a certain role. Firstly, customer experience has a significant contribution to the competitive advantage of a business. Secondly, it retains customers for the business. When customers have good experience with the business, it also means that the business has completed the stepping stone to increase customer loyalty - a key factor in retaining potential customers for the business. Thirdly, enhancing revenue for businesses. Businesses that create positive experiences will have a larger number of customers than those who only can create small ones, which also increases the profit of the business even in the case of a one-time customer (*Nguyen Duong*, 2019). Fourthly, customer experience contributes to the formation of a unique and differentiating point for businesses. Last but not least, businesses will lose customers if the services they provide do not satisfy their customers.

2.2.3. The relationship between lighting system and customers experience

There are several researchers have analyzed the relationship between lighting and customer experience. Nguyen and Leblanc (2002) found out that intangible characteristics can

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influence consumer perception and response, and that intangible characteristics include lighting systems (*Bitner*, 1992). The lighting system has also been considered a stimulus to scrutinize goods (*Baker, J. & Cameron, M.*, 1996; *Brengman, M., & Geuens, M*, 2004).

Within the scope of this research, the authors want to emphasize the relationship between the green lighting systems and customers experience through the elements of the customers experience: Sensorial dimension, Affective dimension, Cognitive dimension, Behavioral dimension, Social dimension.

a) Lighting system affects through Sensorial dimension

Very few topics or theories about the relationship between the lighting system and the Sensorial dimension, but there are some studies showing that human senses are influenced by physical factors, including the lighting systems (*Bitner*, 1992; *D Agapito, J Mendes, P Valle*, 2013).

b) *Lighting system affects through Affective dimension*

The affective dimension of customer experience is based on the arousal of emotional states (*Neher et al.* 2012; *Sheth et al.* 1991), in other words, it is the moods or emotions generated during the shopping trip. (*Schmitt*, 1999). Research into the emotional element of the shopping experience is essential for businesses because "a little bit of positive mood can evolve into strong liking and satisfaction for a brand" (*Yang and He*, 2011).

Some researchers have found that there exists a relationship between the physical environment, which includes light, and customers' emotional responses (*Areni and Kim*, 1994; *Han & Ryu*, 2009; *Ryu & Jang*, 2007). Meanwhile, Alison Jing Xu and Aparna Labroo (2014) asserted that light intensity can dominate emotions. A soft light, which is not too bright, will help customers make rational and informed decisions.

c) Lighting system affects through Cognitive dimension

The Cognitive dimension of customer experience involves the consumer's cognitive processes, including influencing knowledge, thinking, and imagination (*Fornerino*, 2006; *Brakus*, 2009; *Gentile Chiara*, 2007).

Factors in the physical environment, including light, affect not only emotions but also cognitive or perceptual responses (*Kim & Moon*, 2009), which in turn affect the judgment of customers about the quality of the product/service.

d) Lighting system affects through Behavioral dimension

The Behavioral dimension of customer experience is created by validating customers' values or beliefs. This is largely reflected in a certain lifestyle or behavioral modifications (*Gentile et al.* 2007; *Neher et al.* 2012).

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In general, light has a strong influence on human behavior (*Baker and Cameron*, 1996; *Küller, R., Ballal, S., Laike, T., Mikellides, B., & Tonello, G.*, 2006). There are several studies have analyzed the direct influence of lighting in retail stores on various aspects of shopping behavior (e.g. consumer behavior, amount of time spent, and total sales) (*Areni and Kim*, 1994).

e) Lighting system affects through Social dimension

The social dimension of customer experience represents product recognition and consumption among a group of people (*Gentile et al.* 2007; *Neher et al.* 2012). Products can also be a means of affirming social identity, creating a sense of belonging or distinguishing from a social group (*Gentile Chiara*, 2007; *Brakus*, 2009).

An environmentally friendly, energy-efficient lighting system will positively affect the community, create good habits and contribute to building sustainable values (*AK Jägerbrand*, 2015; *VG García, MM Bartolomé*, 2010; *C Boomsma, L Steg*, 2014).

2.2.4. Research theories

- There are several studies have shown a positive relationship between lighting systems and the Sensorial dimension. According to the Architectural Journal of the Vietnam Association of Architects, No. 10-2019: "Light is one of the environmental factors that play an important role in visual comfort". John D. Bullough (2011) also asserts that light has a positive effect on vision. Therefore, this study proposes the following hypothesis:

H1: Green lighting system in shopping center has a positive influence on Sensorial dimension of customer experience.

Many studies have shown that lighting has a positive effect on emotion. Zumtobel Marketing Director Stefan von Terzi once told Dezeen: “As experts in lighting, we know that light affects people's moods, emotions, and therefore happiness.” Kim Dong Hyun (2018) shows that positive emotions can be stimulated by a lighting system in a given space. Therefore, this study proposes the following hypothesis:

H2: Green lighting system in shopping center has a positive influence on Affective dimension of customer experience.

Evans (2006) asserts that the physical environment strongly affects human development, including perception, and that light is an indispensable element of the environment. Therefore, this study proposes the following hypothesis:

H3: Green lighting system in shopping center has a positive influence on Cognitive dimension of customer experience.

Many studies show that human behaviors can be influenced by factors in physical environment, including light (*Cornell*, 2002; *Veltri, Banning and Davies*, 2006; *Tanner*, 2008). According to Retail in Asia (2019), subtle lighting design can influence customers'

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behavior and brand perception, significantly contributing to enhancing the customer experience from the moment they see the products until leaving. Therefore, this study proposes the following hypothesis:

H4: Green lighting system in shopping centerhas a positive influence on Behavioral dimension of customer experience.

When customers feel satisfied with the shopping space that includes lighting, they will keep coming back and eventually become loyal customers, they can even help increase the number of customers for businesses through their relationships. Therefore, this study proposes the following hypothesis:

H5: Green lighting system in shopping center has a positive influence on Social dimension of customer experience.

2.2.5. Model recommendation

Through the above theoretical basis and based on the research model of customer experience of J.Jo˘sko Brakus (2009) and Shuwen Yang (2014), the authors built a new model to determine the degree of influence of green lighting system in shopping center oncustomer experience:

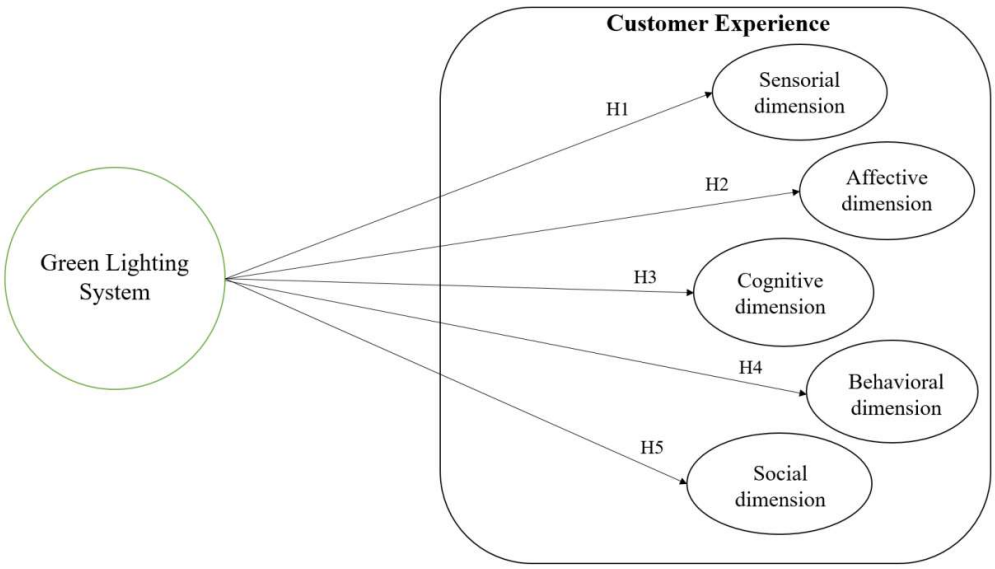

Figure 1: Proposal research model

(Source:Synthesized by research team basing on the research models of J.Jo˘sko Brakus and Shuwen Yang)

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3. RESEARCH METHOD

3.1. Methods of data collection and study samples

During the implementation period, the authors have collected, selected, analyzed, evaluated and inherited the strengths of previous research related to this topic. At the same time, the author conducted interviews with the building management department and the lighting system control unit of AEON Mall Long Bien. The interviewees were department heads, deputy heads, department officials directly involved in building management and the lighting system control.

The sample construction in research is very important. If the sample size is not large enough, the model will not be reliable. According to Gorsuch (1983) and Kline (1979), the minimum sample size to be achieved is 100. Meanwhile, Cattell (1978) believed that the number of samples should be 3 to 6 times more than the number of observed variables. Comrey and Lee (1992) proposed a scale for sample size in factor analysis including: 100 – acceptable, 200 – moderate, 300 – good, 500 – very good, greater than or equal to 1000 – excellent. Based on these grounds, the authors decided to use a sample size of 313.The structure of sample observations is shown in Table 1.

Table 1: Structure of observations of the study sample

	Background Information	Percentage (%)
Age	Under 18 years old	13.4
	From 18 to 30 years old	57.2
	From 31 to 50 years old	15.3
	Above 50 years old	14.1
Gender	Male	47.0
	Female	53.0
Job	Students	65.8
	Personnel	11.5
	Businessmen	9.9
	Officials	8.9
	Homemakers	1.0
	Others	2.9
Frequency of shopping at AEON Mall Long Bien	Rarely (0 – 1 time/month)	54.6
	Sometimes (2 – 3 times/month)	35.8
	Often (4 – 5 times/month)	6.7
	Usually (more than 5 times/month)	2.9

(Source: Synthesized by research team)

3.2. Scale and model concepts

The authors developed the scale on the following steps: (1) Review of previous studies; (2) Qualitative research; (3) Preliminary study on AEON Mall Long Bien; (4) Completing the

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scale.The scale according to the variables and the origin of the scale is summarized in Table 2.

Table 2: Summary of research variables, indicators, scales and origins

Dimension	Observed variables	Scale	Sources	Encryption
Sensorial dimension	AEON Mall Long Bien makes an impression on my senses(sight, hearing, smell, touch, taste)		J.Joˇsko Brakus (2009)	CQ1
	Shopping at AEON Mall Long Bien gives me interesting sensory experience (Example: No glare, soft sound, pleasant scent...)		J.Joˇsko Brakus (2009)	CQ2
	Shopping at AEON Mall Long Bien appeals to my sense		J.Joˇsko Brakus (2009)	CQ3
Affective dimension	AEON Mall Long Bien induces my feelings (Example: luxury, normal, comfortable, ...).		J.Joˇsko Brakus (2009)	XC1
	I have emotions (Example: happy, sad, depressed,...) while shopping at AEON Mall Long Bien.		J.Joˇsko Brakus (2009)	XC2
	Shopping at AEON Mall Long Bien engages me emotionally (Example: happier, sadder,...).		J.Joˇsko Brakus (2009)	XC3
Cognitive dimension	While shopping at AEON Mall Long Bien, I sometimes engage in thinking (Example: when choosing products, restaurants, etc.).		J.Joˇsko Brakus (2009)	NT1
	Shopping at AEON Mall Long Bien stimulatesmy thinking and problem solving		J.Joˇsko Brakus (2009)	NT2
	My creativity can be stimulated while shopping at AEON Mall Long Bien (Example: creativity in fashion,...).		J.Joˇsko Brakus (2009)	NT3

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Behavioral dimension	While shopping at AEON Mall Long Bien, I engage in actions and behaviors (Example: buying products, relaxing, eating, chatting, ...)	The 5-point Likert scale, from level 1 (Completely disagree) to level 5 (Completely agree)	J.Jo˘sko Brakus (2009)	HV1
	I go shopping more since I knew AEON Mall Long Bien		J.Jo˘sko Brakus (2009)	HV2
	Shopping at AEON Mall Long Bien engages me physically (Ex: talking more, talking more...).		J.Jo˘sko Brakus (2009)	HV3
Social dimension	I feel like AEON Mall Long Bien is suitable for community's standards		Gentile Chiara (2007); Shim and Eastlick (1998)	XH1
	I feel like shopping at AEON Mall Long Bien will not receive negative reactions from the community (For example: negative reactions due to harm to the environment, bad effects on the community...).		Gentile Chiara (2007); Shim and Eastlick (1998)	XH2
	I have introduced AEON Mall Long Bien to my acquaintances		Gentile Chiara (2007); Shim and Eastlick (1998)	XH3
Satisfaction with Lighting system	The lighting system brought me many interesting experiences at AEON Mall Long Bien.		Nguyen Thi My (2019)	D1
	I am satisfied with the current lighting system of AEON Mall Long Bien.		Nguyen Thi My (2019)	D2
	In my opinion, AEON Mall Long Bien has the best lighting system		Nguyen Thi My (2019)	D3

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	I feel like the lighting system of AEON Mall Long Bien has a good influence on the community.		Nguyen Thi My (2019)	D4
	In the future I will shop at AEON Mall Long Bien if this place continues to promote or develop the lighting system.		Nguyen Thi My (2019)	D5

(Source:Synthesized by research team)

3.3. Data analysis method

This study use Structural Equation Model (SEM), a widely used model in the fields of customer satisfaction measurement and management. The authors analyzed the data according to the following steps: testing the reliability of the scale with Cronbach's Alpha coefficients, conducting exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), analyzing SEM model, Bootstrap testing.

Step 1: Testing the reliability of the scale: According to Nunally and Berndstein (1994), variables with Cronbach's Alpha coefficients greater than or equal to 0.6 and total correlation coefficient greater than 0.3 are accepted and included in the next tests.

- Cronbach's Alpha coefficient greater than 0.8: High coefficient

- Cronbach's Alpha coefficient ranging from 0.7 to 0.8: Acceptable

- Cronbach's Alpha coefficient ranging from 0.6 to 0.7: Acceptable if a new scale is applied

Step 2: Exploratory Factor Analysis (EFA): Before being included in the analysis, the factors will be screened and testedso that unsuitable factors can be eliminated. During this process, the authorsshould pay attention to the following criteria:

KMO coefficient (Kaiser-Meyer-Olkin): KMO coefficient is used to test whether the sample really fits the elements or not. Factor analysis is appropriate in the study if the KMO value is greater than or equal to 0.5 (*Nguyen Dinh Tho, Nguyen Thi Mai Trang*, 2009).

Bartlett's test: Bartlett's test is used to filter out variables that have no compatibility relationship, or in other words, variables that are not related to each other in a model. If the coefficient Sig of Bartlett's test is less than 0.05, it is accepted (*Nguyen Dinh Tho, Nguyen Thi Mai Trang*, 2009).

Eigenvalues: Eigenvalue is a value used to determine the number of factors in EFA analysis. The condition for a factor to be retained for further analysis is that the Eigenvalue must be greater than or equal to 1 (*Nguyen Dinh Tho, Nguyen Thi Mai Trang*, 2009).

Factor loading coefficient: Factor loading coefficient shows the degree of correlation between factors and observed variables. Observable variables with factor loading coefficients less than 0.5 will be excluded (*Hair et al*, 1998).

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Total variance extracted: The total variance extracted shows how much the extracted factors are condensed and how much of the observed variables is lost. If the total variance extracted is greater than or equal to 50%, the scale will be accepted (*Hair et al*, 1998).

Step 3: Confirmatory factor analysis (CFA): Confirmatory factor analysis CFA is used to check whether the data fit the hypothetical model or not. The CFA analysis process is divided into two stages:

*Stage 1 – Evaluation of model fit:*To evaluate the model fit, the authors relied on a number of references suggested by previous researchers. When the values do not meet the requirements, the model will have to establish new relation pairs with MI (Modification Indices) greater than 4. The table below shows the references used and the sources.

Table 3: References to assess model fit in CFA analysis

	References	Sources
χ^2/df (cmin/df)	< 3: good < 5: acceptable	Hair Jr, Anderson; Hu and Bentler
P-value	< 0.5	Arbuckle and Wothke; Rupp and Segal
GFI	> 0.95: very good > 0.9: good > 0.8: acceptable	Segar and Grover; Chin and Todd; Baumgartner and Homburg
TLI	≥ 0.9	Hair et al
CFI	> 0.95: very good > 0.9: good > 0.8: acceptable	Bentler and Bonet
RMSEA	< 0.05: good 0.05 – 0.10: normal	Steiger; Segar and Grover; Chin and Todd
NFI	> 0.9	Chin và Todd; Hair Jr, Anderson
RMR	≤ 0.08	Hu and Bentler

(Source: Synthesized by research team)

*Stage 2 – Evaluation of reliability, convergence and discrimination:*The authors assessed the reliability and authenticity between groups of variables through the indicators in the table below.

Table 4: Evaluation of reliability, convergence and discrimination in CFA analysis

	Indicators	Reference	Sources
	Standardized Loading Estimates	≥ 0.5: acceptable	

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Reliability		≥ 0.7: good	Hair et al, 2010
	Composite Reliability – CR	≥ 0.7	
Convergence	Average Variance Extracted – AVE	≥ 0.5	
Discrimination	Maximum Shared Variance – MSV	< AVE	
	Square Root of Average Variance Extracted - SQRTAVE	> Inter-Construct Correlations	

(Source: Synthesized by research team)

Step 4: Analyze the SEM model: AMOS software provide many tables, but only 3 tables are used to analyze the SEM model: Regression Weights, Standardized Regression Weights and Squared Multiple Correlations.

Table of Regression Weights: In this table, the authors need to pay attention to the P-value. P-value (Sig value) is the significance level of the independent variable relationships affecting the dependent variable. If these values are less than 0.05, the tested relationships are statistically significant.

Table of Standardized Regression Weights: In this table, the authors have to focus on the column *Estimates*. This column shows the estimated values of the standardized regression coefficients; if the coefficient is greater than 0, it shows a positive effect, if it is smaller than 0, it shows the negative effect between the independent variable and the dependent variable. The relationship with the greatest standardized regression coefficient proves that the influence of the independent variable on the dependent variable is the largest.

Table of Squared Multiple Correlations: In this table, the authors should continue taking notice of the column *Estimates*. This column shows how much percentage the independent variable affects the variation of the dependent variable.

Step 5: Bootstrap test

Bootstrap test helps researchers to once again test the reliability of the model. In the Bootstrap Test Table provided by AMOS software, the research team focused on the following criteria:

Mean: Regression coefficients after Bootstrap test

Bias: Difference between *Mean*and regression coefficients before Bootstrap.

The C.R index (Critical Ratios) is calculated with the formula *C.R = Bias/Se-Bias*, then the authorscompared the absolute value of this index with 1.96. If C.R < 1.96, it is concluded that there is no difference between the regression coefficientsbefore and after Bootstrap test.

4. RESEARCH RESULTS

4.1. Testing the reliability of the scale

In this step, the authors used Cronbach's Alpha coefficient and the total variable correlation coefficient to test the reliability of the scale. Variables whose Cronbach's Alpha is greater

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than or equal to 0.6, total correlation coefficient is greater than 0.3, and at the same time do not reduce the group's Cronbach's Alpha will be included in the next steps. The test results are presented in the table below.

Table 5: Results of testing the reliability of the scale

Dimensions	Variables	Cronbach's Alpha of dimensions	Cronbach's Alpha of dimensions if variable is deleted	Item-Total Correlation	The number of deleted variables
Sensorial dimension (CQ)	CQ1	0.942	0.921	0.870	0
	CQ2		0.916	0.876	
	CQ3		0.906	0.890	
Affective dimension (XC)	XC1	0.957	0.943	0.901	0
	XC2		0.921	0.931	
	XC3		0.947	0.896	
Cognitive dimension (NT)	NT1	0.929	0.893	0.858	0
	NT2		0.880	0.874	
	NT3		0.916	0.830	
Behavioraldimension (HV)	HV1	0.927	0.869	0.882	0
	HV2		0.909	0.833	
	HV3		0.905	0.838	
Socialdimension (XH)	XH1	0.879	0.850	0.745	0
	XH2		0.763	0.841	
	XH3		0.873	0.724	
Satisfaction with Lighting system (D)	D1	0.963	0.948	0.930	0
	D2		0.957	0.874	
	D3		0.952	0.904	
	D4		0.959	0.867	
	D5		0.953	0.899	

(Source: SPSS processing results, 2022)

It can be seen that the overall Cronbach's Alpha coefficients are greaterthan 0.6, and the total variable correlation coefficients are all greater than 0.3, so no variable was excluded, 6 groups with 20 observed variables were included in the exploratory factor analysis process.

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4.2. Explore factor analysis (EFA)

Table 6: Results of EFA

	Variables	KMO	Sig	Eigenvalues	Total Variance Explained	The smallest factor loading
Dimensions of Customer experience	CQ	0.882	0.000	1.139	87.930	0.907
	XC					0.915
	NT					0.911
	HV					0.923
	XH					0.817
Satisfaction with Lighting System	D	0.884	0.000	4.359	87.181	0.914

(Source: SPSS processing results, 2022)

KMO and Bartlett's test

The results show that the values of the KMO coefficient are greater than 0.5. Therefore, it can be proved that the sample is appropriate to continue going into the analysis process.

At the same time, Bartlett's test gives the results of the significance level Sig = 0.000 < 0.05. Therefore, it can be concluded that the given variables are correlated and have sufficient conditions to perform the analysis.

Eigenvalues and Total Variances Extracted

This study uses the method of factor analysis PCA (Principal Component Analysis) and Promax rotation. The results show that there are 6 extracted factors with Eigenvalues greater than 1 (CQ, XC, NT, HV, XH, D), so these variances are kept in the model. The total values of variance extracted are greater than 50%, which meets requirements. The research model is quite well-evaluated.

4.3. Confirmatory factor analysis (CFA)

Stage 1 – Evaluation of model fit

To evaluate the model fit, the authorsused the following indicators: χ2/df, P-value, GFI, TLI, CFI, RMSEA, NFI, RMR, thenassessedthem with several references from previous researchers. The results of testing the fit of the model are shown in the table below.

Table 7: Results of evaluating the model fit

	Results	References	Sources
χ^2/df (cmin/df)	4.147	< 3: good < 5: acceptable	Hair Jr, Anderson; Hu and Bentler

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P-value	0.000	< 0.5	Arbuckle and Wothke; Rupp and Segal
GFI	0.802	> 0.95: very good > 0.9: good > 0.8: acceptable	Segar and Grover; Chin and Todd; Baumgartner and Homburg
TLI	0.914	≥ 0.9	Hair et al
CFI	0.930	> 0.95: very good > 0.9: good > 0.8: acceptable	Bentler and Bonet
RMSEA	0.100	< 0.05: good 0.05 – 0.10: normal	Steiger; Segar and Grover; Chin and Todd
NFI	0.910	> 0.9	Chin và Todd; Hair Jr, Anderson
RMR	0.026	≤ 0.08	Hu and Bentler

(Source: AMOS processing results, 2022)

The results show that all the indicators are acceptable according to the references. Thus, the model is considered to be fit.

Stage 2 - Testing reliability, convergence and discrimination among groups of variables

This stage used the following coefficients and indicators: Standardized Loading Estimates, composite reliability (CR), average extracted variance (AVE), maximum shared variance (MSV) and Fornell & Larcker Table. The results are performed in these tables below.

Table 8: Standardized Regression Weights

Relationships	Standardized Loading Estimates
D1 ← D	0.956
D4 ← D	0.879
D3 ← D	0.913
D2 ← D	0.911
D5 ← D	0.922
XC2 ← XC	0.964
XC3 ← XC	0.922
XC1 ← XC	0.933
NT3 ← NT	0.865
NT1 ← NT	0.908
NT2 ← NT	0.933
CQ2 ← CQ	0.913
CQ3 ← CQ	0.931
CQ1 ← CQ	0.911

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HV2 ← HV	0.874
HV1 ← HV	0.945
HV3 ← HV	0.881
XH2 ← XH	0.912
XH1 ← XH	0.840
XH3 ← XH	0.797

(Source: AMOS processing results, 2022)

Table 9: Results of testing reliability, convergence and discrimination

	CR	AVE	MSV	ASV	HV	D	XC	NT	CQ	XH
HV	0,928	0.811	0.294	0.273	**0.901**					
D	0,963	0.840	0.360	0.318	0.542	**0.917**				
XC	0,958	0.883	0.327	0.287	0.529	0.530	**0.940**			
NT	0,929	0.814	0.298	0.263	0.502	0.546	0.490	**0.902**		
CQ	0,942	0.843	0.355	0.292	0.513	0.596	0.572	0.522	**0.918**	
XH	0,887	0,724	0.360	0.288	0.526	0.600	0.555	0.504	0.491	**0.851**

(Source: StatsToolsPackage processing results, 2022)

The results show that the all Standardized Loading Estimates values are greater than 0.5 and the CR values are greater than 0.7, so the model is reliable.

All the AVE values are greater than 0.5, so the groups of factors in the model are convergent.

The MSV values are all less than AVE, and the square root values of AVE (bold diagonal row in table 9) are greater than Inter-Construct Correlations (shading, table 9), showing that the groups of factors in the model are discriminating.

4.4. Analyzing SEM model

4.4.1. Retesting the fit of SEM model

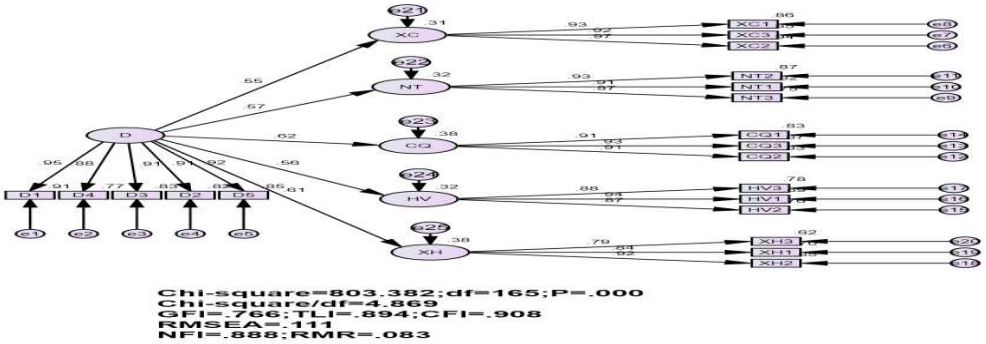

Figure 2: Unadjusted SEM model

(Source: Synthesized by research team)

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Table 10: Results of retesting the fit of SEM model

	Results	References	Sources
χ^2/df (cmin/df)	4.869	< 3: good < 5: acceptable	Hair Jr, Anderson; Hu and Bentler
P-value	0.000	< 0.5	Arbuckle and Wothke; Rupp and Segal
GFI	0.766	> 0.95: very good > 0.9: good > 0.8: acceptable	Segar and Grover; Chin and Todd; Baumgartner and Homburg
TLI	0.894	≥ 0.9	Hair et al
CFI	0.908	> 0.95: very good > 0.9: good > 0.8: acceptable	Bentler and Bonet
RMSEA	0.111	< 0.05: good 0.05 – 0.10: normal	Steiger; Segar and Grover; Chin and Todd
NFI	0.888	> 0.9	Chin và Todd; Hair Jr, Anderson
RMR	0.083	≤ 0.08	Hu and Bentler

(Source: AMOS processing results, 2022)

It can be seen that GFI, TLI, RMSEA, NFI, RMR values do not meet requirements according to the references, showing that the model is not really fit. Based on the principle of establishing new relationships which have MI > 4, the authors established two relationships between e4 – e20 (residuals of D2 and XH3, MI = 62,505) and e2 – e3 (residuals of D4 and D3, MI = 71,420).

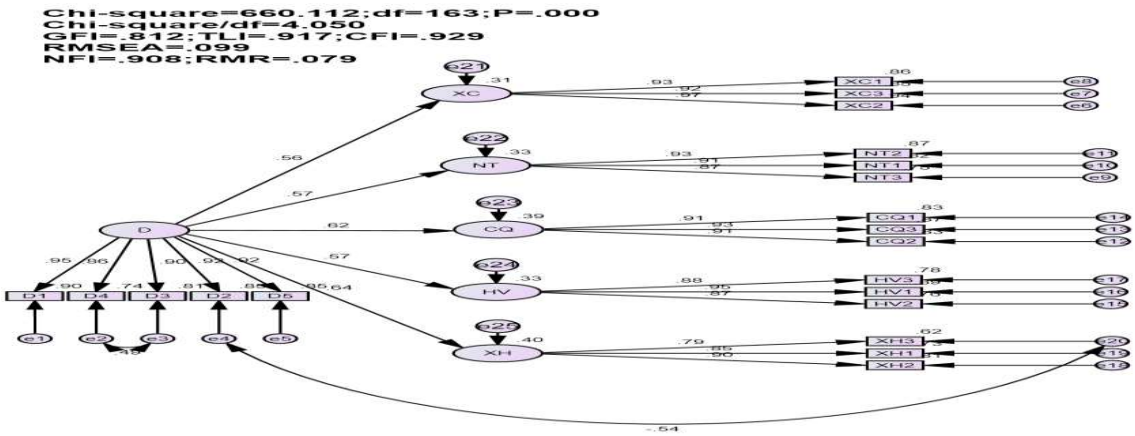

Figure 3: Adjusted SEM model

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(Source: Synthesized by research team)

Table 11: Results of retesting the fit of SEM model (after adjustment)

	Results	References	Sources
χ^2/df (cmin/df)	4.050	< 3: good < 5: acceptable	Hair Jr, Anderson; Hu and Bentler
P-value	0.000	< 0.5	Arbuckle and Wothke; Rupp and Segal
GFI	0.812	> 0.95: very good > 0.9: good > 0.8: acceptable	Segar and Grover; Chin and Todd; Baumgartner and Homburg
TLI	0.917	≥ 0.9	Hair et al
CFI	0.929	> 0.95: very good > 0.9: good > 0.8: acceptable	Bentler and Bonet
RMSEA	0.099	< 0.05: good 0.05 – 0.10: normal	Steiger; Segar and Grover; Chin and Todd
NFI	0.908	> 0.9	Chin và Todd; Hair Jr, Anderson
RMR	0.079	≤ 0.08	Hu and Bentler

(Source: AMOS processing results, 2022)

The results show that the indicators are acceptable according to the references. Thus, the SEM model is considered to be fit after adjustment.

4.4.2. Analyzing SEM model

As described in the section *Data Analysis Methods*, the authors will focus on 3 tables including: Regression Weights, Standardized Regression Weights and Squared Multiple Correlations.

Table 12: Regression Weights

Relationships	Unstandardized Estimates	Sig
XC ← D	0.618	0.000
NT ← D	0.634	0.000
CQ ← D	0.641	0.000
HV ← D	0.561	0.000
XH ← D	0642	0.000

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(Source: AMOS processing results, 2022)

According to Table 12, all the relationships have Sig values = 0.000 < 0.05, showing that they are statistically significant in the model. Thus, D has influences on 5 variables XC, NT, CQ, HV, XH.

Table 13: Standardized Regression Weights

Relationships	Standardized Regression Weights
XC ← D	0.561
NT ← D	0.572
CQ ← D	0.622
HV ← D	0.571
XH ← D	0.636

(Source: AMOS processing results, 2022)

Table 13shows the degree of influence of D on XC, NT, CQ, HV, XH. As can be seen, theStandardized Regression Weight of the relationship between D and XH is the highest (0.636), showing that Lighting System has the strongest influence on the Social dimension of Customer Experience. The influences of D on other dependent variables in descending order are: CQ (0.622), NT (0.572), HV (0.571), XC (0.561). All the Standardized Regressionestimates are greater than 0, showing the positive relationships.

Table 14: Squared Multiple Correlations

Variables	Estimates
XH	0.404
HV	0.326
CQ	0.387
NT	0.327
XC	0.315

(Source: AMOS processing results, 2022)

Table 14 shows the R-squared values of the relationships of D and XH, HV, CQ, NT, XC. The R-squared value of D - XH is the highest (0.404 = 40.4%), so D has influence on 40.4% of XH's variation. At the same time, D has influence on 38.7% of CQ's variation, 32.7% of NT's variation, 32.6% of HV's variation and 31.5% of XC's variation.

4.5. Bootstrap Test

As described in the section *Data Analysis Methods*, the authors need to calculate the C.R index (Critical Ratios) using the formula *C.R = Bias/Se-Bias* and compare the absolute value of this index with 1.96. If C.R < 1.96, there is no difference between the regression weights of Bootstrap Test and the regression weights before going through Bootstrap.

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Table 15: Results of Bootstrap test

Relationships	Regression Weights before Bootstrap test (Estimates)	Regression Weights after Bootstrap test (Mean)	Bias	SE-Bias	C.R
XC ← D	0.561	0.555	-0.006	0.004	-1.5
NT ← D	0.572	0.566	-0.006	0.004	-1.5
CQ ← D	0.622	0.617	-0.005	0.004	-1.25
HV ← D	0.571	0.561	-0.010	0.020	-0.5
XH ← D	0.636	0.630	-0.006	0.008	-0.75

(Source: AMOS processing results, 2022)

The results show that the absolute values of C.R of all 5 relationships are less than 1.96. Therefore, it can be concluded that the model is reliable.

5. CONCLUSION

Research with the aim of evaluating the influence of the green lighting system on customer experience has shown a number of remarkable results.

The relationships between the independent variable and the dependent variables have been analyzed and clarified in the research paper. Specifically:

With 95% reliability, all five hypotheses H1, H2, H3, H4, H5 are accepted.

Green lighting system has positive influence on all five dimensions of customer experience: Sensorial, Affective, Cognitive, Behavioral, Social dimension. Social dimension is most strongly influenced, followed by Sensorial dimension, Cognitive dimension, Behavioral dimension, and Affective dimension. Thereby, the research team came to the conclusion: The Green lighting system in shopping center has positive influence on customer experiences.

Thus, when shopping centers apply and develop green lighting systems, they will create good influences on the sensorial, affective, cognitive, behavioral and social dimension of customers. These five dimensions make up customer experience - a very important field in the existence and development of businesses in general and shopping centers in particular. Thereby, managers can propose measures to increase the operational efficiency of shopping centers in the long run.

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