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The Role of User Experience in the Impact of Low-Carbon Building Characteristics on Consumer's Housing Purchase Intention

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Abstract: While residential buildings account for a small proportion of global energy consumption, their significance in terms of energy usage and environmental impact should not be underestimated, especially considering population growth and urbanization. Consequently, low-carbon building has gained popularity as a new architectural form. This article first presents a theoretical model with low-carbon building characteristics as the independent variable, consumer purchase intention as the dependent variable, and user experience as the mediating variable. Subsequently, data were collected through a survey questionnaire. Finally, regression analysis and sequential testing were used to examine the influence of low-carbon building characteristics on consumers' housing purchase intentions and the mediating role of user experience. The findings reveal a significant positive influence of low-carbon building characteristics on consumer housing purchase tendency, with user experience playing a crucial mediating role. Therefore, real estate companies should prioritize the incorporation of low-carbon building characteristics and continuously enhance user experience in the design, development, and marketing of residential properties to increase consumer purchase intention. This research provides empirical evidence and theoretical support to elucidate the relationship between low-carbon buildings and consumer purchase intention in China.

Keywords: low-carbon building; low-carbon building materials; green design; user experience; purchase tendency

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1. Introduction

The issue of energy consumption and environmental impact in residential buildings is becoming increasingly prominent. According to statistics from the International Energy Agency, residential buildings account for approximately 17% of global energy consumption, with significant consumption in areas such as electricity, heating, and cooling. Additionally, the construction, renovation, and maintenance processes of residential buildings generate a large amount of solid waste, wastewater, and construction debris, among other pollutants. Thus, the importance of residential buildings in terms of energy consumption and environmental protection cannot be ignored. However, sustainability in residential buildings has always been a challenging problem to solve. With the growing awareness of environmental protection, more and more people are paying attention to energy efficiency, environmental friendliness, and sustainability issues in residential construction [1,2]. As a result, low-carbon housing has emerged as a new form of residential building [3]. Low-carbon housing refers to a residential construction approach that aims to minimize energy consumption and environmental impact throughout the design, construction, and usage processes. By employing advanced building technologies and materials, as well as adopting scientific architectural design and management methods, low-carbon housing

can significantly reduce energy consumption and carbon emissions while improving the environmental adaptability and livability of residential spaces [4,5].

With the intensification of global climate change and the advancement of national environmental protection policies, the Chinese government has introduced a series of policies and standards to encourage and guide the residential construction industry towards a low-carbon and environmentally friendly direction. At the national level, the government's encouragement and guidance for the residential construction industry to transition towards low-carbon and environmentally friendly practices not only helps address global climate change and reduce environmental pollution but also contributes to achieving the country's environmental protection goals and fulfilling commitments to climate change. It can also promote the development of emerging low-carbon industries, create job opportunities, and enhance economic competitiveness [6,7]. Simultaneously, with the popularization of the concept of low-carbon housing, an increasing number of consumers are beginning to pay attention to healthy and environmentally friendly living environments. From a market perspective, low-carbon housing not only provides comfortable living spaces for consumers but also meets their demands for environmental protection. Therefore, the potential of the low-carbon housing market is continuously growing. As real estate developers, engaging in the development of low-carbon housing not only responds to the country's environmental protection policies but also helps further expand the low-carbon housing market.

Existing research has extensively explored low-carbon housing from two perspectives. Firstly, advancements in technology have provided possibilities for achieving low-carbon buildings. Scholars have studied and analyzed low-carbon building materials and their applications, green lifecycle energy consumption, environmental impacts, and other aspects. They have found that the use of low-carbon technologies and environmentally friendly materials can significantly reduce energy consumption and environmental impacts of buildings while also providing economic and environmental benefits [8]. These research findings further support the promotion and development of low-carbon buildings and provide technical guidance for the design and construction of low-carbon housing [9,10]. Secondly, residences with low-carbon characteristics have a significant impact on consumers' purchasing decisions. Blackwell [11] and Fishbein [12] have conducted foundational research in areas related to consumer purchasing decisions and preferences. Their studies indicate that consumers are more willing to choose homes with environmentally friendly and low-carbon characteristics. This suggests that low-carbon housing has a competitive advantage in the market and can attract more consumers. In addition, scholars such as Wei [13], Zhen [14], and Jiang [15] have conducted research and analysis on low-carbon building materials and their applications, green lifecycle energy consumption, and environmental impacts. Their research has found that low-carbon buildings not only have significant environmental advantages but also have notable economic benefits. These research findings provide economic support for the promotion and development of low-carbon housing, further enhancing consumer recognition and acceptance of homes with low-carbon characteristics. Comprehensive research also reveals that factors such as consumer experience, brand image, service quality, and perceived value significantly influence consumer willingness to purchase and loyalty towards products or services [16–18]. Existing research focuses on improving technology to provide possibilities for achieving low-carbon buildings and explores the impact of low-carbon housing with specific characteristics on consumer purchasing decisions. However, there is still insufficient systematic research on the application of low-carbon building characteristics, consumer user experience, and housing purchasing preferences in China, which requires further in-depth exploration to provide more theoretical and practical support and promote the widespread application and development of low-carbon housing in China.

In light of this context, this paper presents a theoretical model with low-carbon building characteristics as the independent variable, consumer housing purchase intention as the dependent variable, and user experience as the mediating variable. By examining the impact of low-carbon building characteristics on consumer housing purchase intention, the

study concludes that low-carbon building characteristics have a significant positive effect on consumer housing purchase intention, with user experience playing a crucial mediating role. This research provides a more practical perspective on how low-carbon building characteristics influence consumer housing purchase intention, enabling housing developers and policymakers to better understand consumers' housing purchase decisions and preferences, and offering valuable insights and guidance for the promotion and widespread adoption of low-carbon buildings. Moreover, the introduction of the mediating variable, user experience, in this study helps businesses gain a deeper understanding of consumers' perceptions and demands regarding low-carbon building characteristics, providing novel ideas and approaches for low-carbon building design and marketing. Furthermore, this study offers important references and guidance for advancing sustainable development in the residential construction industry, and holds positive significance for enhancing the market competitiveness and societal value of low-carbon buildings [19].

2. Theory and Hypothesis

2.1. Theoretical Basis

2.1.1. Purchase Tendency

In the field of psychology, "tendency" is a concept that generally refers to an inclination or propensity of individuals or groups in certain contexts or tasks. According to Sears' definition, tendency is an internal factor of people's consciousness, beliefs and emotions, which can influence their choices and behaviors [20]. Extending this concept, purchase tendency refers to the inclination, attitude and behavioral tendency of an individual when purchasing a certain product or service, which may affect their purchase decisions and behaviors. Mowen and Minor define purchase tendency as the inclination and willingness of consumers to purchase a certain product or service in a certain context [21]. Mullet believes that purchase tendency is the subjective probability of consumers choosing to purchase a certain product, which can be used to predict their purchase behavior under specific circumstances [22]. Schiffman and Kanuk define purchase tendency as the likelihood and probability of consumers purchasing a certain product or service [23]. Based on domestic and foreign research literature, this paper summarizes purchase tendency as the inclination and subjective probability of consumers choosing to purchase a certain product or service under specific circumstances, which may be influenced by multiple factors.

2.1.2. Characteristics of Low-Carbon Buildings

Low-carbon buildings achieve energy conservation and emission reduction goals by optimizing the design of building materials, structures, and equipment to reduce energy consumption and carbon emissions. The "people-oriented" nature of low-carbon buildings emphasizes the design of ventilation, lighting, insulation, and heat insulation to improve building safety, stability, and reliability through material selection and energy-saving technology, thereby improving living quality and creating healthier and more comfortable indoor environments. Meanwhile, "environmental livability" aims to minimize the impact of buildings on the surrounding environment and ecosystem, focusing on the mutual influence between buildings and the natural environment to achieve harmonious coexistence, coordination, and sustainable development of the three elements: buildings and people, buildings and nature, and people and nature.

According to the Chinese "Building Energy Efficiency Standard" (GB 50189-2015) [24], low-carbon buildings are defined as buildings that meet human needs while reducing the energy consumption and greenhouse gas emissions of buildings throughout their lifecycle, improving building environmental quality, making contributions to the ecosystem and socio-economic development, integrating building design, construction, operation, and management, and pursuing sustainable development. Low-carbon buildings prioritize the use of environmentally friendly, renewable, and low-carbon emission materials in their material selection. For instance, renewable wood, recycled materials, and materials produced with low energy consumption are employed to reduce reliance on finite resources

and minimize environmental impacts. Based on this definition, this study explains the meaning of low-carbon building characteristics as a series of techniques and strategies used in building design, material selection, construction, and use to achieve environmentally friendly and sustainable goals in energy conservation, emission reduction, and resource utilization.

Based on the definition and evaluation criteria of low-carbon buildings, as well as the research on low-carbon building design and practice in the literature review, this paper summarizes the characteristics of low-carbon buildings into two dimensions: (1) the application of low-carbon building materials, which are building materials that meet building quality and function requirements while possessing characteristics such as energy-saving, environmental protection, and high efficiency; (2) green design, also known as sustainable design or ecological design, which refers to the practice of incorporating environmentally friendly and sustainable principles into the design process. This involves creating buildings, spaces, and products that utilize green elements such as plants and natural materials to enhance the ecological sustainability of the architecture, aiming to minimize negative impacts on the environment and promote sustainable living. In low-carbon buildings, green design is one of the important means to achieve energy efficiency and emission reduction.

2.1.3. User Experience

User experience has been widely recognized as a significant determinant of consumer purchasing behavior in the academic community [25,26]. User experience refers to users' subjective feelings and responses when using a product, service, or system, encompassing aspects such as the experience and perception of the product or service's usage process, effects, and sensations. Different scholars have studied user experience from dimensions such as internal attributes, external attributes, functional attributes, abstract concepts, emotional value, usage scenarios, and social significance. For example, Sauer and Scheiner divided user experience into two dimensions: internal attributes and external attributes. Internal attributes include the product's physical features and technical implementation, such as interface design and system response speed, while external attributes refer to users' experiences and reactions when using the product or service, such as satisfaction and trust [27]. Hassenzahl and Tractinsky classified user experience into two dimensions: functional attributes and abstract concepts. Functional attributes refer to the product or service's functional performance, such as whether the product's functions are complete and the service's quality meets standards, while abstract concepts refer to the values and cultural connotations conveyed by the product or service, such as brand image and corporate culture [25]. Desmet and Hekker divided user experience into two dimensions: emotional value and usage scenarios. Emotional value refers to the emotional information and experience conveyed by the product or service, such as the pleasure and comfort of emotional experience, while usage scenarios refer to the different experiences and reactions that the product or service generates in different usage scenarios, such as at home and in public places [28]. Forlizzi and Battarbee classified user experience into two dimensions: sensory and emotional experience, and meaning and impact [29]. Meaning and impact include the product or service's impact and role in society, such as environmental protection and public welfare experiences and reactions. Based on the existing academic research on the dimensions of user experience, this study categorizes the functional performance and effects of low-carbon building characteristics provided to consumers as the functional value of user experience, the emotional information and experience conveyed to consumers as the emotional value of user experience, and the social impact and role produced for consumers as the social value of user experience. These three dimensions are used to refine the measurement of user experience.

2.2. Research Hypothesis

2.2.1. Impact of Low-Carbon Buildings on Consumer Housing Purchases

Luo, Kanzaki and Matsushita, as well as other scholars, have pointed out that among the many factors affecting the purchase of houses, low-carbon houses are highly valued by consumers, particularly young consumers, in Beijing and Shanghai. Previous research has shown that consumers weigh the importance of green energy, wood structure, and indoor environmental quality (including lighting, air quality, temperature control, and efficacy, etc.) as 55.7%, 20.5%, and 16.2%, respectively [30]. Horsky also found that low-carbon buildings significantly reduce the trading time for consumers compared to traditional buildings [31]. Liu discovered that the green certification of buildings has a significant impact on consumers' purchase tendency [32]. Several studies have also revealed that consumers' awareness of green indicators and green buildings is positively correlated with their willingness to purchase houses and make purchase decisions. Wang and Jiang's research findings indicate that consumers have a relatively low level of awareness regarding low-carbon buildings; however, the low-carbon building characteristics, such as energy-saving and environmental friendliness, have a significant positive impact on purchase tendency [33].

Wang's research indicated that more and more Chinese consumers, including industrial and commercial users, are willing to pay higher fees for renewable electricity due to the increasing environmental awareness of the public [34]. Luo's study found that various groups of individuals hold distinct viewpoints regarding the price premium of low-carbon buildings. Specifically, higher-income groups are more price-sensitive, while well-educated consumers are more inclined to pay a premium for green buildings [30,35]. Studies about the influence of green building characteristics on housing purchase tendency in foreign countries have also been conducted. The research findings by Qiu and He indicate that consumers possess a relatively low level of awareness regarding low-carbon buildings. However, they exhibit a high degree of recognition and tendency to pay a premium for low-carbon buildings due to their energy-saving and environmental characteristics [36]. Patel found that consumers in India are willing to pay a premium of no more than 5% for houses with low-carbon building characteristics [37]. Jat and Mane's study also supported this view, suggesting that factors such as consumers' environmental attitudes, low-carbon awareness, construction factors, and social influences significantly affect consumers' tendency to pay a premium for low-carbon housing [38]. Studies have shown that more than 60% consumers are willing to pay a premium of 1–5% for green-featured homes, and even when the premium increases by 6–10%, 23% of consumers are still willing to pay the premium [39]. Consumers' recognition of low-carbon houses is not only reflected in their tendency to buy and pay a premium, but also in the tendency to recommend low-carbon houses to their relatives and friends. For example, Li found that consumers are willing to recommend low-carbon certified houses to relatives and friends; meanwhile, the purchase behaviors of low-carbon buildings by acquaintances positively affects consumers' tendency to purchase low-carbon houses [40].

Based on the analysis, this study proposes the following research hypotheses:

H1: *The low-carbon building characteristics have a positive impact on consumers' tendency to purchase houses.*

H1-1a: *The application of low-carbon building materials has a positive impact on consumers' tendency to purchase houses.*

H1-1b: *The application of low-carbon building materials has a positive impact on consumers' tendency to pay a housing premium.*

H1-1c: *The application of low-carbon building materials has a positive impact on consumers' tendency to recommend houses.*

H1-2a: *Green design has a positive impact on consumers' tendency to purchase houses.*

H1-2b: *Green design has a positive impact on consumers' tendency to pay a housing premium.*

H1-2c: *Green design has a positive impact on consumers' tendency to recommend houses.*

2.2.2. Impact of Low-Carbon Building Characteristics on User Experience

The energy consumption of heating, air conditioning, lighting, and ventilation in the construction industry is immense. According to statistics from 2001, the annual consumption of buildings accounted for 27.6% of all energy consumption in that year [14]. The use of low-carbon building materials has a unique functional value: inorganic lightweight panels integration, surface coating, and thermal insulation materials can enhance exterior wall insulation, thus reducing heat loss; transparent glass and shading designs can lower indoor temperature and avoid excessive air conditioning usage in summer; energy-saving lamps can save electricity and increase luminance; application construction design can be used to achieve whole demolition and recycling of buildings; segmented toilet design can save water; non-toxic building materials can reduce formaldehyde and carbon emissions [15,41–43].

Furthermore, low-carbon buildings prioritize the adaptation to local conditions, minimize the utilization of hazardous chemicals, incorporate topography, geomorphology, vegetation, and water systems for landscape design and layout, enhance green spaces, mitigate noise pollution, enhance air quality, advocate for land conservation and water storage, and promote biodiversity [40,44,45]. These low-carbon building characteristics not only provide a high-quality living environment but also give consumers a healthy and comfortable living experience, meeting the emotional requirements of consumers' physical and mental pleasure and sentiment, and fitting the concepts of "people-oriented" and "environment livable" [46]. With the excessive consumption of natural resources, global warming is accelerating, environmental pollution is becoming more and more serious, and the environmental awareness and social responsibility of the construction industry and housing consumers are gradually becoming stronger. Saving energy, reducing environmental impact, and achieving sustainable development of earth's resources and the relationship between humans and nature are the inevitable trends for the future development of the construction industry [30].

In summary, low-carbon building offers high functional value in terms of efficiency, energy savings, safety, and health, while also providing emotional value through creating comfortable and pleasant living and working environments. Additionally, low-carbon building provides significant social value in terms of promoting low carbon environmental protection and sustainable development. Based on this understanding, the following research hypotheses are proposed:

H2: *Low-carbon building characteristics have a positive impact on consumers' housing purchase tendency.*
H2-1a: *The application of low-carbon building materials has a positive impact on functional value.*
H2-1b: *The application of low-carbon building materials has a positive impact on emotional value.*
H2-1c: *The application of low-carbon building materials has a positive impact on social value.*
H2-2a: *Green design has a positive impact on functional value.*
H2-2b: *Green design has a positive impact on emotional value.*
H2-2c: *Green design has a positive impact on social value.*

2.2.3. Impact of User Experience on Housing Purchase Tendency

The quality of user experience can directly influence purchase decisions. If consumers are satisfied with the experience of a product or service, they are more likely to purchase it, and will be more willing to make repeat purchases or recommend it to others. Conversely, if consumers are dissatisfied with the experience of a product or service, they may choose not to purchase or may select alternative options. Excellent customer experience can enhance consumer satisfaction and loyalty, and increase purchase intent and brand advocacy. Consumer user experience is comprised of different dimensions, such as significant internal and external product attributes, perceived quality, and abstract meanings such as reputation and convenience. Consumer experiences with various product attributes, prices, and costs can directly influence their purchase decisions. Dong's research indicates that the purchase intent of online consumers is positively influenced by their user experience

with online products and services, including functional value, emotional value, and social value [47]. Online consumers value the experience of online shopping, with emotional value having the greatest impact on purchase intent, followed by functional value, and social value having the smallest impact due to the limitations of the investigated product category (apparel and accessories). To assist businesses in comprehensively understanding consumer housing needs and expectations, many scholars have studied consumer housing preferences from the perspectives of functional value, emotional value, and social value of user experience. Firstly, functional value of user experience has a significant impact on housing purchase intent, which can be increased by improving the functionality, convenience, and trustworthiness of the housing. Emotional value is also an important factor in customer experience, with a significant positive impact on housing purchase intent [48–50]. In modern society, people are increasingly concerned about issues such as corporate social responsibility and environmental protection. Studies have shown that social value has a significant positive impact on housing purchase intent, and developers should focus on increasing the social value of housing to enhance consumer satisfaction and loyalty. Chang investigated the impact of sustainable architecture on consumer housing purchase decisions, where the most important housing purchase-influencing factor was functional value (operational performance such as lighting, water conservation, and insulation, as well as waste reduction), followed by social value (benefiting the reduction of energy and resource consumption, the improvement of the ecological system and ozone layer, the delay of global warming, and the improvement of the human living environment), and lastly, emotional value (improvement of quality of life) [51]. Therefore, for real estate developers, increasing the functional, emotional, and social value of their products can increase consumer housing purchase intent, improve product market competitiveness and brand image, and ultimately achieve long-term business development.

Based on the previous research on the impact of user experience on consumers' purchase tendency, this study proposes the following research hypotheses:

H3: *Consumer user experience has a positive impact on consumers' tendency to buy houses.*
H3-1a: *Functional value has a positive impact on purchase tendency.*
H3-1b: *Functional value has a positive impact on the tendency to pay a premium.*
H3-1c: *Functional value has a positive impact on the tendency to recommend.*
H3-2a: *Emotional value has a positive impact on purchase tendency.*
H3-2b: *Emotional value has a positive impact on the tendency to pay a premium.*
H3-2c: *Emotional value has a positive impact on the tendency to recommend.*
H3-3a: *Social value has a positive impact on the purchase tendency.*
H3-3b: *Social value has a positive impact on the tendency to pay a premium.*
H3-3c: *Social value has a positive impact on the tendency to recommend.*

2.2.4. The Mediating Role of User Experience

According to the above analysis, as the concept of low-carbon buildings becomes more prevalent and consumer awareness of environmental protection increases, low-carbon buildings, as an environmentally friendly and energy-saving form of architecture, will have an important impact on consumers' decisions to purchase homes. The influence of low-carbon building characteristics on consumers' housing preferences is not only due to their environmental and energy-saving advantages, but also because they can provide a better user experience. For example, in low-carbon buildings, more advanced air treatment, temperature control, and other systems are used to provide a more comfortable living environment while reducing noise and pollution. This increase in comfort and health can significantly improve users' satisfaction and quality of life, further affecting their purchasing preferences. Secondly, user experience can have a direct impact on consumers' thinking and behavior. In low-carbon buildings, the quality of the user experience can directly influence consumers' perceptions and evaluations of the building. For example, users can easily adjust indoor temperature, humidity, and other parameters using intelligent control systems in low-carbon buildings, improving convenience and comfort and making con-

sumers more inclined to purchase low-carbon buildings. In addition, user experience can directly influence consumers' behavioral decisions, such as consumers being more inclined to choose this type of housing because of the comfort and health advantages in low-carbon buildings. Therefore, user experience can indirectly influence consumers' purchasing preferences for low-carbon building characteristics through its impact on consumers. Overall, the above research indicates that user experience plays a mediating role in the impact of low-carbon building characteristics on consumers' housing purchase preferences, and low-carbon building characteristics can increase consumers' willingness to purchase by improving user experience.

Based on the above research on the relationship between user experience and housing preferences in the consumer participation process, we propose the following research hypotheses:

H4: *User experience plays a mediating role in the impact of low-carbon building characteristics on consumers' tendency to buy houses.*
H4-1-1a: *Functional value plays a mediation effect in the impact of the application of low-carbon building materials on the purchase tendency.*
H4-1-1b: *Functional value plays a mediation effect in the impact of the application of low-carbon building materials on the tendency to pay a premium.*
H4-1-1c: *Functional value plays a mediation effect in the influence of the application of low-carbon building materials on the tendency to recommend.*
H4-2-1a: *Functional value plays a mediation effect in the influence of green design on the purchase tendency.*
H4-2-1b: *Functional value plays a mediation effect in the influence of green design on the tendency to pay a premium.*
H4-2-1c: *Functional value plays a mediation effect in the influence of green design on the tendency to recommend.*
H4-1-2a: *Functional value plays a mediation effect in the impact of the application of low-carbon building materials on the purchase tendency.*
H4-1-2b: *Emotional value plays a mediation effect in the impact of the application of low-carbon building materials on the tendency to pay a premium.*
H4-1-2c: *Emotional value plays a mediation effect in the impact of the application of low-carbon building materials on the tendency to recommend.*
H4-2-2a: *Emotional value plays a mediation effect in the impact of green design on the purchase tendency.*
H4-2-2b: *Emotional value plays a mediation effect in the impact of green design on the tendency to pay a premium.*
H4-2-2c: *Emotional value plays a mediation effect in the impact of green design on the tendency to recommend.*
H4-1-3a: *Social value plays a mediation effect in the impact of the application of low-carbon building materials on the purchase tendency.*
H4-1-3b: *Social value plays a mediation effect in the impact of the application of low-carbon building materials on the tendency to pay a premium.*
H4-1-3c: *Social value plays a mediation effect in the influence of the application of low-carbon building materials on the tendency to recommend houses.*
H4-2-3a: *Social value plays a mediation effect in the influence of green design on the purchase tendency.*
H4-2-3b: *Social value plays a mediation effect in the influence of green design on the tendency to pay a premium.*
H4-2-3c: *Social value plays a mediation effect in the influence of green design on the tendency to recommend.*

Based on the analysis presented above, this paper builds a research model to examine the influence of low-carbon building characteristics on the tendency to buy houses (see Figure 1).

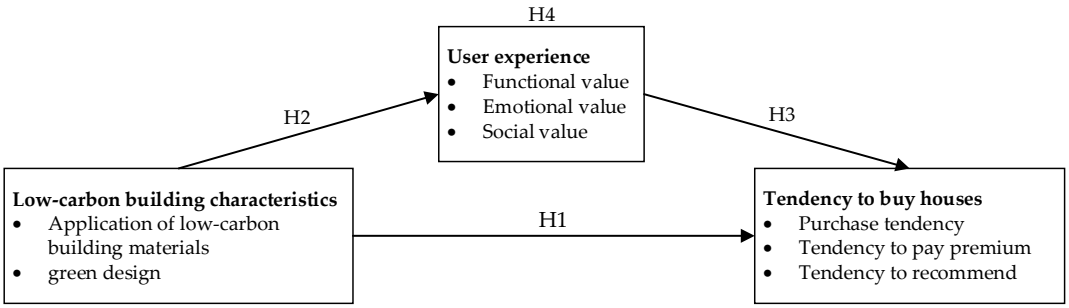

Figure 1. Theoretical model.

3. Research Design

3.1. Questionnaire Design and Data Collection

According to the research purpose, the questionnaire is divided into two sections: the influence of low-carbon building characteristics and personal background on purchase tendency. The first section covers the application of low-carbon building materials (energy consumption, cost control, operational performance, waste reduction cycle), green design (greening degree, chemical pollution, land water conservation, and ecological diversity), user experience (functional value, emotional value, social value), and tendency to buy houses (purchase tendency, tendency to pay premium, and tendency to recommend). The items were measured using a Likert five-level scale, with respondents selecting the items they agreed with from the five options of "strongly disagree", "disagree", "ordinary", "agree", and "strongly agree". If consumers have the tendency to pay a premium for a house with low-carbon building characteristics, they only need to choose the range of payment premium that they are most likely to accept from the five options of "5% and below", "6–10%", "11–15%", "16–20%", and "more than 20%". The second section is personal background, including gender, marital status, number of children, age, education level, occupation, personal or family annual income, whether they meet the Guangzhou (Zhengzhou) city purchase restrictions, and plans to buy a housing area, unit price, and total price, for a total of 12 questions. The respondents only need to tick the corresponding questions according to their actual background. To ensure the quality of the questionnaire data and the effectiveness of the questionnaire, the number of questions in this part of the impact of low-carbon building characteristics on purchase tendency was set to 60, so that the total length of the whole questionnaire did not exceed 10 min, allowing respondents to fill in the questionnaire patiently and carefully.

This study employed an online method of questionnaire distribution using Questionnaire Star. Respondents from various demographic backgrounds were invited to fill the survey out via WeChat and offline channels. In total, 262 questionnaires were distributed and recovered in Guangzhou and 325 in Zhengzhou; 587 valid questionnaires were collected overall. Of these, 308 were male respondents (52.5%), and 279 were female (47.5%). The majority of the population (over 70%) was between the ages of 26 and 45, the main demographic with economic stability and purchasing power. The number of those aged 25 or below was no more than 20%, and those aged 56 or above no more than 10%. The age group of the sample generally reflected the age characteristics of buyers, and the marital status survey showed that the overall proportion of married people was close to 60%, with single (or divorced) people accounting for about 40%. This 3:2 married:single (or divorced) ratio of the population is closer to the composition of the real estate transaction market population, and the data were more reliable. Most of the respondents were enterprise staff, accounting for 43% of the total, while personnel of organizations and institutions, and professionals (e.g., accountants, lawyers) accounted for 24%. The proportions of each factor in this study sample were reasonable. See Appendix A Table A1 for details.

3.2. Variable Measurement

The independent variables of this paper are the characteristics of low-carbon buildings, including the application of low-carbon building materials and green design. The application of low-carbon building materials has an important impact on consumers' tendency to buy houses. Consumers not only hope that the application of building materials can reduce energy consumption and achieve cost control but also hope they improve operational performance and reduce waste. Based on the above discussion, this paper draws on the mature measurement scale of Zhang [52] and other scholars, designing 15 measurement items. Green design makes houses comfortable and beautiful, close to nature, conducive to the physical and mental health of the occupants and the harmonious coexistence of people, buildings, and the environment. Consumers hope that green design can increase the degree of community greening, avoid or reduce chemical pollution, facilitate land and water conservation, and promote ecological diversity. Based on this analysis, this paper draws on the mature measurement scale of Zhang [52] and other scholars, and designs 13 measurement items.

The dependent variable of this paper is the tendency to buy houses. Drawing on the existing research [52], the purchase tendency to buy houses is divided into three categories: purchase tendency, tendency to pay a premium, and tendency to recommend low-carbon houses.

The mediating variable in our model is user experience, which is based on the existing research of Zhang [52]. Lei [53] divided user experience into three dimensions (including twelve measurement items): functional value, emotional value, and social value.

Furthermore, we control for factors such as gender, age, education, marital status, number of children, occupation, number of house purchases, family or personal annual income, and so on.

3.3. Model Design

To test the validity of H1 and H2, H3, a basic regression model, is constructed based on the works of Liu and Yao [54,55].

$$Tendency_i = \beta_0 + \beta_1 LBC_i + \sum \beta_j Control_i + \varepsilon_i \quad (1)$$

$$User_i = \beta_0 + \beta_1 LBC_i + \sum \beta_j Control_i + \varepsilon_i \quad (2)$$

$$Tendency_i = \beta_0 + \beta_1 user_i + \sum \beta_j Control_i + \varepsilon_i \quad (3)$$

In this equation, i represents different survey subjects, β_0 is the intercept term, $Control_i$ represents the control variables, and ε_i is the random disturbance term. The same applies to the following.

According to Wen [56], the results of the serial mediation test have the highest credibility. Therefore, this article uses the serial mediation test to examine whether user experience, as an intermediate variable influenced by the low-carbon building characteristics, affects consumers' tendency to purchase a house. The model is set as follows:

$$Tendency_i = \beta_0 + cLBC_i + \sum \beta_j Control_i + \varepsilon_i \quad (4)$$

$$User_i = \beta_0 + aLBC_i + \sum \beta_j Control_i + \varepsilon_i \quad (5)$$

$$Tendency_i = \alpha_0 + c'LBC_i + bUser_i + \sum \beta_j Control_i + \varepsilon_i \quad (6)$$

Among these, Equation (4) examines whether the impact of low-carbon building characteristics on consumer housing purchase tendency is significant; Equation (5) examines whether the impact of low-carbon building characteristics on the mediating variable (user

experience) is significant; Equation (6) examines whether the mediating variable (user experience) has a significant impact on consumer housing purchase tendency after controlling for the influence of low-carbon building characteristics.

If the regression coefficient c in Equation (4) is significant, the regression coefficient a in Equation (5) is significant, and the coefficient b in Equation (6) is significant, but not significant, then this mediator is a complete mediator. If the regression coefficient c in Equation (4) is significant, the regression coefficient a in Equation (5) is significant, the coefficient b in Equation (6) is significant, but c' is also significant and its value decreases, then the mediation is considered partial mediation. In all other cases, we consider the mediating effect to be non-existent.

4. Empirical Result Analysis

4.1. Variables Descriptive Statistics and Correlation Analysis

The mean, standard deviation and correlation coefficient of independent variables, dependent variables and moderating variables are presented in Table 1.

Table 1. Variable descriptive statistics and correlation coefficient.

	Mean	SD	Material	Green Design	Functional	Emotional	Social	Purchase	Pay Premium	Recommendation
Material	4.02	0.58	1							
Green design	4.13	0.58	0.834 **	1						
Functional	4.15	0.6	0.812 **	0.856 **	1					
Emotional	4.2	0.65	0.707 **	0.782 **	0.839 **	1				
Social	4.12	0.66	0.731 **	0.782 **	0.836 **	0.842 **	1			
Purchase	3.94	0.71	0.692 **	0.699 **	0.719 **	0.736 **	0.789 **	1		
Pay premium	-	-	0.300 **	0.219 **	0.215 **	0.199 **	0.269 **	0.436 **	1	
Recommendation	3.98	0.68	0.700 **	0.703 **	0.723 **	0.742 **	0.769 **	0.832 **	0.404 **	1

Note: ** indicates $p < 0.05$.

The relationship between the correlation coefficients of variables can also serve as a means of assessing the validity of the proposed research hypotheses to some extent. By examining these correlations, we can gain insight into the interdependencies among variables and determine if they align with our expectations and assumptions. It is evident from the above Table 1 that there is a positive correlation between the two dimensions of low-carbon building characteristics and the three dimensions of purchase tendency, as well as between the three dimensions of user experience and the three dimensions of purchase tendency. Therefore, the correlation relationships listed in Table 2 provide preliminary support for our conclusions.

Table 2. Reliability analysis of variables.

Variable	Number	Cronbach's α
Material	15	0.93
Green design	13	0.94
Functional	6	0.91
Emotional	3	0.92
Social	3	0.88
Purchase	3	0.85
Pay premium	1	-
Recommendation	3	0.92

4.2. Reliability and Validity Analysis

SPSS Statistics 23 software was used to analyze the reliability of the questionnaire variables in this study. As shown in Table 2, the Cronbach alpha values of all variables and item reliability analysis are greater than 0.8, indicating high reliability and satisfactory item design.

The analysis method used for the questionnaire in this study is structural validity analysis: Firstly, the variables were tested using the KMO measure and Bartlett's sphericity test to confirm the suitability of the data for factor analysis. Then, exploratory factor analysis and confirmatory factor analysis were employed to assess the structural validity of the questionnaire survey. Generally, a KMO value of greater than 0.8 indicates excellent validity, a KMO value between 0.7 and 0.8 indicates good validity, a KMO value between 0.6 and 0.7 indicates acceptable validity, a KMO value between 0.5 and 0.6 indicates poor validity, and a KMO value below 0.5 indicates unqualified validity. As shown in Table 3, all variables in this paper have KMO values greater than 0.8, and the significance probability of Bartlett's test of sphericity is 0.000, indicating that the scale has good content validity.

Table 3. KMO and Bartlett values of each variable.

		Material	Green Design	Functional	Emotional	Social	Purchase	Pay Premium
KMO		0.943	0.95	0.873	0.759	0.739	0.713	0.752
Bartlett	χ^2	5214.6	5091.4	2450.1	1273.7	966.4	846.6	1308.6
	df	105	78	15	3	3	3	3
	P	0	0	0	0	0	0	0

Confirmatory factor analysis is used to examine whether the relationships between the measurement items align with the theoretical relationships of the research design. This paper will utilize χ^2/df, CFI, TLI, RMSEA, and SRMR to assess the fit of the factor structure model. The corresponding values are presented in Table 4. The chi-square value and degree of freedom ratio of the measurement model in this study is 3.51, the CFI value is 0.872, which is close to 0.9, and the TLI is 0.862, which is considered acceptable. The RMSEA value is 0.065, indicating a reasonable fitting. The SRMR value is 0.053, indicating a good fitting degree. Overall, based on the measurement of each fit index, the hypothesis model of the influence of low-carbon building characteristics on consumer purchase tendency proposed in this study is deemed acceptable.

Table 4. Confirmatory factor analysis test parameters.

Index	Value
χ^2	5411.783
df	1540.000
χ^2/df	3.514
CFI	0.872
TLI	0.862
RMSEA	0.065
SRMR	0.053

This study further uses SPSS23 software to conduct confirmatory factor analysis on the variable model to verify the convergent validity of the measurement model. Generally, if the factor loading coefficient of each measurement index and the measurement model is between 0.5 and 0.95, the measurement variables can be considered acceptable. The results of the confirmatory factor analysis test parameters of this study indicate that the factor loading coefficients of all measurement items meet this criterion, being greater than 0.5 and less than 0.95. See Appendix A Table A2 for details.

4.3. Hypothesis Results

4.3.1. Direct Effect Testing

According to the data in Table 5, the model adjustment R^2 value of the sample is between 0 and 1, with a significant *p* value less than 0.01, indicating a significant regression effect and an acceptable setting of the regression model. The application of low-carbon

building materials and green design had a significant impact on the purchase tendency and the tendency to recommend ($p < 0.001$), and a significant effect on the tendency to pay premiums ($p < 0.001$) for the former, but not the latter ($p = 0.14$). Therefore, we assume that H1-1a, H1-2a, H1-1b, H1-1c, and H1-2c hold, while H1-2b does not. Furthermore, the application of low-carbon building materials and green design has a significant effect on the functional value, emotional value, and social value ($p < 0.01$). Thus, H2-1a, H2-2a, H2-1b, H2-2b, H2-1c, and H2-2c are all assumed to be supported. Notably, empirical research findings indicate that green design does not have a significant impact on consumers' tendency to pay a premium, which contradicts the hypothesis proposed in this study. There may be two main reasons for this discrepancy. Firstly, the tendency to pay a premium is associated with consumers' higher levels of housing purchase tendency. Housing purchase itself is a substantial personal and family expenditure, and the additional cost of paying a premium may be financially burdensome. Secondly, the application of low-carbon building materials and green design corresponds to the indoor and outdoor environments of the house, respectively. Consumers perceive the indoor environment as more directly relevant to their quality of living, while the outdoor environment is of secondary importance. This could be another reason why empirical research fails to find a significant influence of green design on consumers' housing purchase tendency.

Table 5. Direct effect test results.

Hypothesis	Dependent	Adjusted R^2	Significance	Independent	Coefficient	Independent Variable Significance	Support
H1-1a	Purchase	0.526	***	Material	0.36	***	Yes
H1-2a				Green design	0.399	***	Yes
H1-1b	Pay premium	0.09	***	Material	0.387	***	Yes
H1-2b				Green design	−0.105	0.143	No
H1-1c	Recommendation	0.535	***	Material	0.372	***	Yes
H1-2c				Green design	0.393	***	Yes
H2-1a	Functional	0.763	***	Material	0.321	***	Yes
H2-2a				Green design	0.588	***	Yes
H2-1b	Emotional	0.62	***	Material	0.181	***	Yes
H2-2b				Green design	0.631	***	Yes
H2-1c	Social	0.631	***	Material	0.257	***	Yes
H2-2c				Green design	0.568	***	Yes
H3-1a	Pay premium	0.64	***	Functional	0.11	*	Yes
H3-2a				Emotional	0.195	***	Yes
H3-3a				Social	0.532	***	Yes
H3-1b	Recommendation	0.07	***	Functional	0.016	0.846	No
H3-2b				Emotional	−0.102	0.218	No
H3-3b				Social	0.342	***	Yes
H3-1c	Purchase	0.626	***	Functional	0.153	**	Yes
H3-2c				Emotional	0.252	***	Yes
H3-3c				Social	0.429	***	Yes

Note: *** indicates $p < 0.01$, ** indicates $p < 0.05$, * indicates $p < 0.1$.

Overall, the impact of green design on consumer user experience is far greater than that of the application of low-carbon building materials. The three dimensions of consumer user experience (functional value, emotional value, and social value) have a significant impact on the purchase tendency and the tendency to recommend ($p < 0.05$). Moreover, consumers' social value has a significant impact on the tendency to pay premiums ($p < 0.001$), whereas functional value and emotional value have no significant influence on the tendency to pay premiums. Therefore, we can infer that H3-1a, H3-2a, H3-3a, H3-3b, H3-1c, H3-2c, and H3-3c hold, and H3-1b and H3-2b do not hold. It is noteworthy that consumers tend to pay a premium only when they perceive the social value of the house, whereas functional value and emotional value have no effect on their tendency to pay a premium. The results are

inconsistent with our proposed research hypotheses. This study suggests that the reason behind this discrepancy may lie in the significant resource and energy consumption of the construction industry, which has a high degree of environmental and social impact. As a result, only low-carbon buildings that possess social value (environmental and social benefits) can motivate consumers to be willing to pay additional costs. This viewpoint is also supported by the regression coefficients, where the influence of social value on consumer housing purchase intention is the highest among the three dimensions, followed by emotional value, and functional value being the least influential.

4.3.2. Mediating Effect Testing

Taking the three dimensions of user experience (functional value, emotional value, and social value) as mediating variables, the two dimensions of low-carbon building characteristics (application of low-carbon building materials and green design) as independent variables, and the three dimensions of consumers' tendency to buy houses (purchase tendency, tendency to pay a premium, and tendency to recommend) as dependent variables, regression analysis and bootstrap tests were conducted. The results, shown in Table 6, indicate that the application of low-carbon building materials and green design have a significant positive impact on the functional value, emotional value, and social value of the mediating variables ($p < 0.001$). Additionally, functional value, emotional value, and social value also have a significant positive impact on the purchase tendency and tendency to recommend ($p < 0.001$). The premise of the mediating role is satisfied. After the bootstrap test, the 95% confidence interval of the indirect effect regression coefficient does not contain 0 (the smaller and larger values are both greater than 0), and the coefficient product is positive and significant. Therefore, the research hypotheses H4-1-1a, H4-1-1c, H4-2-1a, H4-2-1c, H4-1-2a, H4-1-2c, H4-2-2a, and H4-2-2c are supported, and the mediating effect hypothesis of functional value and emotional value is established. Based on the mediating effect, and the 95% confidence interval of the direct effect not containing 0 (the smaller value and the larger value are both greater than 0), these results indicate that they are all partial mediators.

Although the application of low-carbon building materials and green design had a significant impact on the functional value of the intermediary variable ($p > 0.05$), the premise of the intermediary role was not satisfied. After the bootstrap test, the 95% confidence interval of the indirect effect contained 0 (the smaller value was negative and the larger value was positive, and the coefficient product was not significant). Therefore, the hypotheses H4-1-1b, H4-2-1b, H4-1-2b, H4-2-2b, and H4-1-3b were not supported.

Table 6 shows that the application of low-carbon building materials and green design has a significant positive impact on the social value of the intermediary variable ($p < 0.001$); at the same time, social value has a significant positive effect on the purchase tendency and tendency to recommend ($p < 0.001$). Moreover, when the independent variable is green design, social value also has a significant impact on the tendency to pay a premium ($p < 0.05$). The premise of a mediating role is satisfied. After a bootstrap test, the 95% confidence interval does not contain 0 (smaller and larger values are greater than 0), and the coefficient product is positive and significant. Thus, the research hypotheses H4-1-3a, H4-1-3c, H4-2-3a, H4-2-3b, and H4-2-3c are supported, and the mediating effect hypothesis of social value is established.

Based on the mediating effect and research hypotheses H4-1-3a, H4-1-3c, H4-2-3a, and H4-2-3c, the 95% confidence interval of the direct effect does not contain 0 (with smaller and larger values both being greater than 0). This indicates that the social value in the four basic assumptions is partially mediated. For research hypothesis H4-2-3b, the 95% confidence interval of the direct effect contains 0 (with the smaller value being less than 0 and the larger value being greater than 0), indicating that the social value in the basic hypothesis is completely mediated.

Table 6. Mediating effect tests.

Hypothesis	Independent	Dependent	Mediator	Coefficient a		Coefficient b		Indirect Effect and 95% Confidence Interval			Direct Effect and 95% Confidence Interval			Support
				Value	Significance	Value	Significance	Value	LLCI	ULCI	Value	LLCI	ULCI	
H4-1-1a	Material	Purchase	Functional	0.832	***	0.542	***	0.45	0.3503	0.5493	0.386	0.2745	0.4986	Partial
H4-1-1b	Material	Pay premium	Functional	0.832	***	-0.194	0.222	−0.161	−0.4155	0.1135	0.877	0.5539	1.1903	No
H4-1-1c	Material	Recommendation	Functional	0.832	***	0.512	***	0.426	0.3379	0.5161	0.38	0.2787	0.4795	Partial
H4-2-1a	Green design	Purchase	Functional	0.89	***	0.532	***	0.475	0.3695	0.5863	0.386	0.2508	0.5045	Partial
H4-2-1b	Green design	Pay premium	Functional	0.89	***	0.249	0.174	0.215	−0.1154	0.5316	0.309	−0.0638	0.6863	No
H4-2-1c	Green design	Recommendation	Functional	0.89	***	0.51	***	0.455	0.3494	0.5637	0.37	0.2542	0.4953	Partial
H4-1-2a	Material	Purchase	Emotional	0.788	***	0.535	***	0.422	0.3532	0.4966	0.418	0.3315	0.5058	Partial
H4-1-2b	Material	Pay premium	Emotional	0.788	***	-0.059	0.626	−0.042	−0.228	0.1571	0.767	0.4784	1.0277	No
H4-1-2c	Material	Recommendation	Emotional	0.788	***	0.512	***	0.405	0.3415	0.475	0.406	0.3208	0.4872	Partial
H4-2-2a	Green design	Purchase	Emotional	0.884	***	0.529	***	0.468	0.3817	0.5615	0.392	0.2867	0.4952	Partial
H4-2-2b	Green design	Pay premium	Emotional	0.884	***	0.154	0.27	0.133	−0.1042	0.3777	0.398	0.0993	0.7084	No
H4-2-2c	Green design	Recommendation	Emotional	0.884	***	0.512	***	0.452	0.3733	0.5334	0.373	0.2822	0.4715	Partial
H4-1-3a	Material	Purchase	Emotional	0.821	***	0.653	***	0.533	0.4613	0.6104	0.302	0.2163	0.3883	Partial
H4-1-3b	Material	Pay premium	Emotional	0.821	***	0.226	0.067	0.186	−0.0073	0.3869	0.541	0.2542	0.8113	No
H4-1-3c	Material	Recommendation	Emotional	0.821	***	0.569	***	0.466	0.3993	0.5346	0.342	0.2563	0.4325	Partial
H4-2-3a	Green design	Purchase	Emotional	0.892	***	0.671	***	0.598	0.5097	0.6909	0.257	0.1628	0.3585	Partial
H4-2-3b	Green design	Pay premium	Emotional	0.892	***	0.538	***	0.482	0.2353	0.7294	0.054	−0.2454	0.348	Full
H4-2-3c	Green design	Recommendation	Emotional	0.892	***	0.58	***	0.519	0.4416	0.6009	0.308	0.2121	0.3992	Partial

Note: *** indicates $p < 0.01$.

Empirical research has shown that consumers' tendency to pay a premium is only mediated by social value when the independent variable is green design, and this mediation is complete. However, when the independent variable is green design but the mediating variables are functional value and emotional value, no mediating effects are observed. This result contradicts the research hypothesis but aligns with the findings regarding the impact of user experience on consumer housing purchase intention: among the three dimensions of perceived value, social value has the greatest influence on consumers' willingness to pay a premium for low-carbon building characteristics. The reason behind this can be attributed to the lack of significant effects of the green design dimension of the aforementioned low-carbon building characteristics on consumers' willingness to pay a premium, as well as the lack of significant effects of the functional value and emotional value dimensions of user experience on willingness to pay a premium. Therefore, it is reasonable to conclude that willingness to pay a premium is not mediated by dimensions of user experience other than social value. These results indicate that although consumers are willing to purchase and recommend housing, convincing them to pay additional costs for already expensive homes can be challenging [57].

5. Conclusions and Outlook

5.1. Research Conclusion

This study presents a research model on the influence of low-carbon building characteristics on consumers' housing purchase tendency. Building upon the previous literature, this study proposes research hypotheses suggesting that low-carbon building characteristics have a positive impact on consumers' housing purchase tendency and introduces a theoretical model of user experience as a mediator. The research findings are as follows:

(1) Low-carbon building characteristics have a positive influence on consumers' tendency to purchase a house. Two dimensions of low-carbon building characteristics, namely the application of low-carbon materials and green design, positively affect two dimensions of consumers' housing purchase tendency (purchase tendency and recommendation tendency). Although consumers' tendency to pay a premium is also positively influenced by the application of low-carbon materials, it is not significantly affected by the dimension of green design. (2) Low-carbon building characteristics have a significant positive impact on consumers' user experience. Both dimensions of low-carbon building characteristics (application of low-carbon materials and green design) have a significant positive influence on three dimensions of user experience (functional value, emotional value, and social value). (3) User experience has a positive impact on consumers' purchase tendency. The three dimensions of user experience (functional value, emotional value, and social value) have a significant positive influence on purchase tendency and recommendation tendency. Additionally, social value significantly influences consumers' tendency to pay a premium. However, functional value and emotional value do not have a significant impact on consumers' tendency to pay a premium. (4) User experience plays a mediating role in the impact of low-carbon building characteristics on consumers' housing purchase tendency. The three dimensions of user experience (functional value, emotional value, and social value) partially mediate the influence of low-carbon building characteristics on two dimensions of consumers' housing purchase tendency (purchase tendency and recommendation tendency) in a positive manner. However, consumers' tendency to pay a premium is only fully mediated by social value when the independent variable is green design. In conclusion, the findings of this study indicate that low-carbon building characteristics positively influence consumers' housing purchase tendency, with user experience playing an important mediating role.

5.2. Research Significance

This study provides empirical evidence and theoretical support for the relationship between low-carbon buildings and consumer purchasing behavior in China. It reveals the significant role of different dimensions of low-carbon building characteristics and user

experience in influencing consumer housing preferences. This offers a more scientific and effective direction and strategy for low-carbon building and sustainable development in China, which is of great significance for promoting the sustainable development of the construction industry and encouraging green consumption among consumers. Firstly, low-carbon buildings are an important measure for sustainable development as they can reduce energy consumption and carbon emissions, thus contributing to China's low-carbon economy goals. Secondly, low-carbon buildings provide better user experiences, which can enhance consumer satisfaction and brand loyalty, positively influencing marketing strategies for businesses. Lastly, low-carbon buildings align with the sustainable development strategies advocated by the Chinese government and are expected to receive policy support and market promotion.

Based on these research findings, policymakers and businesses can take several measures to promote the development of low-carbon buildings. Firstly, relevant policies should be formulated to encourage companies to adopt low-carbon technologies and materials in building design and construction, thereby improving energy efficiency and environmental friendliness. Secondly, incentives such as tax reductions, rewards, and subsidies can be implemented to encourage consumers to purchase low-carbon building products, stimulating market demand. Finally, businesses can enhance sustainable marketing through promotion and advertising, increasing consumer awareness and trust in low-carbon buildings, thereby improving brand competitiveness and market share. In conclusion, promoting low-carbon buildings holds important theoretical and practical significance [58]. Governments and businesses should work together to promote the development and adoption of low-carbon buildings, driving the construction of a more environmentally friendly, energy-efficient, and sustainable society in China.

5.3. Future Research

This study provides meaningful recommendations for low-carbon building feature housing development and marketing based on questionnaire surveys conducted in the cities of Guangzhou and Zhengzhou. However, the study also has certain limitations, including the sample size and empirical research methods. Specifically, the survey questionnaire in this paper only includes two cities, and the sample size is limited. Therefore, the generalizability and representativeness of the results need further exploration. In addition, the distribution of the survey questionnaire has certain limitations as well, as an online approach may overlook individuals who are not accustomed to using electronic devices. Lastly, the empirical research method in this paper primarily relies on questionnaire surveys and does not involve interviews with industry professionals or consumers, which may affect the accuracy and comprehensiveness of the research findings. To further enhance the reliability and effectiveness of the research, we suggest expanding the sample survey to include more cities in subsequent studies to broaden the scope of the research sample. Additionally, it is important to explore multiple methods of distributing the questionnaire to ensure its comprehensiveness and representativeness. Furthermore, we recommend employing various methods for data collection and analysis in empirical research, such as case studies, interviews, on-site investigations, etc., to ensure the comprehensiveness and credibility of the research findings.

To summarize, the findings and recommendations of this study are based on thorough analysis of existing data and reliable research methods. Despite certain limitations, we believe these findings have reference value for low-carbon building characteristics, housing development, and marketing. In future research, we will continue to explore more comprehensive and effective research methods to further improve the quality and level of this area of research.

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Appendix A

Table A1. Sample demographic characteristics.

		Number of Samples	Percentage
Gender	males	308	52.5%
	female	279	47.5%
Marital status	married	349	59.5%
	single (or divorced)	238	40.5%
Number of children	0	252	42.9%
	1	172	29.3%
	2	146	24.9%
	3	10	1.7%
	4 and above	7	1.2%
age	25 and below	94	16.0%
	26–35	319	54.3%
	36–45	132	22.5%
	46–55	37	6.3%
	56 and above	5	0.9%
Education level	primary or junior high school	49	8.3%
	high school or technical secondary school	102	17.4%
	college or undergraduate	338	57.6%
	master	73	12.4%
	doctor	25	4.3%
Occupation	organs and institutions	98	16.7%
	professionals (accountants/lawyers, etc.)	42	7.2%
	Enterprise staff	254	43.3%
	individuals/business people/private owners	26	4.4%
	other	167	28.4%
Family annual income	10 million and below	242	41.2%
	10 million to 30 million	242	41.2%
	31 million to 50 million	60	10.2%
	51 million to 80 million	21	3.6%
	81 million and above	22	3.7%
Number of existing houses	0	355	60.5%
	1	144	24.5%
	2	68	11.6%
	3 and above	20	3.4%
Whether they are eligible to buy a house	Yes	308	52.6%
	No	279	47.5%

Table A2. Confirmatory factor load coefficient.

Variable	Code	Load	Variable	Code	Load
Material	EC1	0.589	Functional	VF1	0.798
	EC2	0.689		VF2	0.685
	EC3	0.702		VF3	0.784
	EC4	0.7		VF4	0.814
	EC5	0.676		VF5	0.87
	CC1	0.658		VF6	0.848
	CC2	0.695	Emotional	VE1	0.866
	CC3	0.685		VE2	0.897
	OP1	0.658		VE3	0.903
	OP2	0.735	Social	VS1	0.831
	OP3	0.754		VS2	0.87
	RC1	0.763		VS3	0.842
	RC2	0.726	Purchase	PD1	0.865
	RC3	0.724		PD2	0.88
	RC4	0.732		PD3	0.715
Green Design	GD1	0.637	Recommendation	RD1	0.855
	GD2	0.753		RD2	0.92
	GD3	0.791		RD3	0.899
	GD4	0.813			
	CP1	0.594			
	CP2	0.64			
	CP3	0.699			
	WC1	0.818			
	WC2	0.698			
	WC3	0.786			
	ED1	0.842			
	ED2	0.754			
	ED3	0.807			

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