

## Article

# Exploring the Relationship between Chinese Urban Residents' Perceptions of Sustainable Consumption and Their Efficiency Behavior: A Mediation and Moderation Analysis Based on the Social Practice Approach

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**Abstract:** There exists a problem of insufficient perception of sustainable consumption and the “perception–action paradox” among Chinese urban residents. To address this problem, we construct a holistic research framework, integrating micro and macro levels based on the “Social Practice Approach”, with lifestyle as the mediating variable and supply conditions as the moderating variable. This study aims to reveal the relationship between the sustainable consumption perception and efficiency behaviors of Chinese urban residents, as well as the associated influence mechanisms. Our results show that a sustainable consumption perception exerts a significantly positive influence on four dimensions of lifestyle and efficiency behaviors. Significant differences are explicitly identified among the four dimensions of lifestyle on efficiency behavior, and the mediating effect between sustainable consumption perception and efficiency behaviors, especially the development concern and price concern. Product sustainability perception and product facility availability conditions significantly positively moderate the relationship between sustainable consumption perception and efficiency behavior. Exploring the four dimensions of lifestyle and their deep-seated mediation effect on efficiency behavior will broaden the theoretical perspective of efficiency behavior research and guide sustainable consumption practices in China.

**Keywords:** sustainable consumption perceptions (SCP); efficiency behavior; social practice approach (SPA); lifestyles; product sustainability perception (PSP); product facility supply conditions (PFSC)

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## 1. Introduction

Along with the rapid growth of the global population and economic development over the past years, sustainable development has been a popular theme linking environmental challenges to economic development. In response to resource depletion and environmental challenges, many countries worldwide have gradually built consensus and taken concerted actions to implement “Carbon Neutrality”. According to The Emissions Gap Report 2021 released by the United Nations Environment Program (UNEP), about 2/3 of global emissions are household-related, with the transportation, residential, and food sectors each contributing about 20% of daily emissions. Indeed, the growth of consumption is not stopping; the deteriorating environmental problems, as well as the ongoing COVID-19 pandemic, call us to rethink and reshape the consumption patterns. In other words, the only action that we can take is to develop sustainable lifestyles and consumption patterns as soon as possible.

Researchers around the world have yielded fruitful research contributions in studying sustainable consumption and countermeasures. Specifically, Abrahamse et al. [1] classified sustainable consumption into two types, namely efficiency behavior and curtailment behavior. They also pointed out the most significant difference between them. The former refers to one-shot purchase behavior with a certain amount of initial investment, such as purchasing energy-efficient refrigerators, new energy vehicles, and green food, but reduces energy consumption and costs in the long run. The latter is a kind of energy-saving behavior with repetitive efforts, in which consumers do not require an initial investment to achieve energy-saving behavior but need to change their behavior habit or lifestyles, such as sharing transportation, energy conservation, waste disposal, recycling, etc. Consumers are requested to spend extra time and effort because of such kind of behavior, even it will reduce their comfort level or cause “trouble” or “inconvenience”. Gardner and Stern [2] argued that the energy-saving potential of efficiency behaviors was greater than that of curtailment behavior, which was considered an effective measure to reduce energy consumption and daily carbon emissions [3,4] and to alleviate energy shortages [5].

As the largest developing economy, China urges all citizens to actively practice sustainable consumption and promote low-carbon lifestyles through a series of strategies and policies. According to the report on sustainable consumption in China released by Dairy Company Yili Group in 2018, over 90% of Chinese consumers were aware of sustainable consumption, and 70% were very conscientious of it. The most common five phrases that consumers mentioned are waste classification, recycling, environmental protection, low carbon emission, and cooperative economy. However, sustainability in China only contributes 20% of consumption [6]. The sustainable consumption behaviors of Chinese urban residents are mainly manifested in curtailment behavior such as turning off lights, saving food and water resources, and using reusable bags. In contrast, the efficiency behaviors involving the purchase of sustainable products are poorly performed [7]. This is mainly because citizens encounter diverse barriers in executing efficiency behaviors, such as the unavailability or high prices of sustainable products [8], difficulties in perceiving the effectiveness of actions, or discomfort of lifestyle due to inadequate facilities. One of the main reasons is the lack of theoretical knowledge and policy implementation [6]. The Sustainable Consumption in China 2021 Report indicates that approximately 35% of survey respondents regard sustainability as an important factor for purchasing decisions in all categories, but one out of four think sustainability claims are exploited by brands for the benefit of selling products at higher prices [9]. Thus, insufficient knowledge of sustainable consumption [8] prevents Chinese citizens from acquiring positive perceptions of sustainable consumption and the effectiveness of their actions, resulting in a lack of motivation to overcome high-cost action barriers and difficulties in lifestyle transformations. Encouraging consumers to engage in sustainable product purchasing faces many difficulties and challenges in China [10].

The current study contributes to the existing literature and managerial practice from several aspects, showing the following characteristics. Firstly, the few existing studies on sustainable consumption can clearly distinguish efficiency behavior and curtailment behavior [11]. Most of them focused on curtailment behavior, such as green travel [12], waste classification [13,14], e-waste domain regulation [15], clothing reuse [16], and public environmental behavior [17], while relatively few studies addressed the purchase of green products [18] such as new-energy vehicles [19], greenhouses, green food [20], and green clothing [21]. Owing to two types of behavior that may result in different behavioral spillover effects, such as positive or negative, the public policies adopted should naturally be different between fostering efficiency behaviors and promoting curtailment actions [11]. Secondly, most existing studies on efficiency behavior adopt the TPB theoretical model [22,23], which assumes that an individual's behavior is determined by their intentions, which in turn are influenced by their attitudes towards their behavior, subjective norm, and perceived behavioral control [24], whereas has difficulty in explaining the attitude-

behavior gap [25]. In other words, individuals may have positive attitudes towards purchasing sustainable products, but they ultimately fail to generate purchase intentions due to the social pressure (social norms) they experience from their peers. Furthermore, the TPB begins with an explicit definition of the behavior of interest covering its target, the action involved, the context in which it occurs, and the time frame. However, once the behavior is redefined, the other four factors in TPB theory must then correspond to the behavior, i.e., the principle of compatibility among influencing factors [24]. Indeed, we should take the dynamic nature of the existing factors (e.g., the impact of contextual changes, consumers' habits, and technological innovations derived from sustainable products) and the additional factors into account in studying efficiency behavior. Therefore, the current findings are not yet able to respond to the difficulties and challenges posed by lifestyle maladjustment in promoting sustainable consumption, it is crucial to integrate micro-behaviors (e.g., individual's sustainability perception) with a macro-social context (e.g., availability of sustainability products and supply conditions) in the study of efficiency behavior, so that residents' specific lifestyles and the influence of supply conditions on behavior can be investigated. However, the current studies on efficiency behavior from a holistic perspective are limited, especially in China. The Social Practice Approach (SPA) [26] provides a flexible framework that precisely meets the above requirements and offers a new perspective for studying efficiency behavior.

This study targets urban residents, as they are primary and guiding consumers in China. Taking the "social practice approach" as the theoretical basis, we aim to explore the relationship between urban residents' perceptions of sustainable consumption and their efficiency behavior and analyze the influence mechanisms of lifestyle and supply conditions in this regard. The research questions of this paper are as follows.

- (1) How does perception of sustainable consumption influence the efficiency behavior of Chinese urban residents?
- (2) How does lifestyle influence the efficiency behavior of Chinese urban residents?
- (3) How does the availability of sustainability products and facilities positively contribute to the efficiency behavior of Chinese urban residents?

The remainder of this paper is structured as follows: Section 2 offers a comprehensive literature review and hypotheses development. Section 3 presents the research methodology, followed by Section 4, which demonstrates the results of empirical investigation in detail. Then, Section 5 focuses on a discussion of all findings. The paper finishes with theoretical contributions and implications in Section 6, and the conclusion and research limitations in Section 7.

## 2. Literature Review and Hypotheses Development

### 2.1. Efficiency Behavior

The concept of sustainable consumption is usually used to describe issues related to human needs, equity, quality of life, resource efficiency, waste minimization, life-cycle thinking, consumer health and safety, consumer sovereignty, etc. So far, there is no uniform and explicit definition [27]. Overall, sustainable consumption describes consumers' responsibility through individual efforts and action to change their consumption habits and adapt their lifestyles. It is regarded as an effective measurement in reducing the negative impacts of their consumption on the environment and eco-systems [28].

As one important type of sustainable consumption, efficiency behavior (EB) [11,29] refers to the behavior of long-term energy saving through one-shot investment to purchase sustainable products with low energy consumption, high energy efficiency, and environmental friendliness (e.g., new-energy vehicles, low-carbon houses, energy-efficient home appliances, green clothing.). As sustainable products adopt the energy-efficient product systems, they are more expensive than regular products, requiring an initial financial investment to purchase energy-efficient equipment/technology, but, in the later period, it no longer requires any individual sacrifice and can be implemented only once

or even infrequently to take full advantage of the energy savings [30]. Efficiency behavior is currently considered to be a low-frequency behavior that does not require repeated efforts [31] and is one of the essential measures to reduce energy consumption and daily carbon emissions [32].

Currently, studies related to efficiency behavior mainly focus on green products [24,33], such as home appliances [34], green automobiles [22,23,35–37], green housing [38], green food [39], and green clothing [21,40]. Studies generally use the theory of planned behavior to examine the effects of individual knowledge, attitudes, subjective norms, and intentions on efficiency behavior from the “consumers” themselves [41–44]. However, the obvious “altruistic” tendency implied in efficiency behavior and the required “high-input” of green products may result in a conflict between social and personal interests. The purchase of energy-efficient equipment and the utilization of advanced technologies can benefit society by improving the environment, but consumers must bear a higher level of product premiums and require additional time and effort [45]. This conflict is particularly evident when consumers have limited knowledge of sustainable products; they face difficulties in information searches and product performance risks [46,47], as well as in perceiving the effects of their actions in the short term [23]. Hence, efficiency behavior decisions are much more complex than curtailment behavior decisions. Many factors such as consumers’ perceptions [48], lifestyles, behavioral habits, and the external environment [49,50] may influence efficiency behavior.

## 2.2. Social Practice Approach

The Social Practice Approach (SPA), proposed by Dutch environmental sociologist Gert Spaargaren in the 1990s [25], is a conceptual framework suitable for analyzing different socio-cultural contexts over time. It has been widely used in housing, food, communication, clothing, energy, water resources, and waste services in Europe and has developed hotspots of research on lifestyles, social practices, social innovation, and systems innovation. This approach avoids analyzing sustainable consumption solely from the supply or consumption side [51], while linking the consumer’s micro behavior to the macro social context to study the actor’s specific lifestyle and the influence of the supply system on the actor’s consumption behavior. Its characteristics focus on consumption behavior by examining the more profound reasons, interests, and motivations, and the context behind individual consumer behavior in social practices that are shared in a specific time and space and with others. This approach provides a more integrated and comprehensive conceptual framework for understanding sustainable consumption issues in China. On the one hand, it is important to provide knowledge and skills related to sustainable consumption practices for social members to promote sustainable lifestyle changes. On the other hand, it is necessary to strengthen the diffusion of sustainable environmental technologies and infrastructures in the broader society and utilize rules and resources to promote sustainable consumption. It has been shown that consumers’ efficiency behavior can be influenced by individual attributes, product attributes [52,53], or situational factors. Still, very few empirical studies have been conducted based on a holistic perspective. This study considers that, when citizens have enough sustainable consumption perceptions, they are more likely to perceive the sustainability value of products, the favorable rules and conditions, and convenient product facilities, and finally perform efficiency behaviors successfully.

## 2.3. Direct Effect of Sustainable Consumption Perception on Efficiency Behavior

Perception, as a part of cognition, is regarded as the basic ability to capture, process, and make sense of the information received by individuals. The perceptual process begins with the environment and leads to individuals’ perception of a stimulus and action in response to the stimulus, which involves using existing knowledge and generating new knowledge and is dynamically constructed in part through participation in cultural practices [54]. Based on cognitive-behavioral theory, cognition and behavior are significantly

positively correlated, and both are mutually reinforcing [55]. Perception biases may lead to the inability to make rational behavioral decisions, and both changes in an individual's internal cognition and external behavioral changes will eventually affect behavioral changes in individuals [56].

Sustainable consumption perception (SCP) [57] is defined as the cognitive process through which persons interpret and understand acquired and applied information related to sustainable consumption and react appropriately. When individuals acquire sustainability knowledge or experiences, they may develop the cognition of sustainable consumption norms through perception, sensation, and memory, and then adjust their lifestyles to reduce environmental impacts. Sustainable consumption perception is people's understanding of the broad socio-technical and cultural context in which they behave and is an important factor underpinning sustainable consumption behavior [58], which can be said to represent people's implicit worldviews [59]. The better an individual's perception of sustainable consumption, the easier they will perceive the value of sustainable products. Consequently, they will be more likely to think about the causes, consequences, and solutions of resource and environmental problems. Ultimately, individuals become more active and responsible for protecting the environment and are more likely to engage in pro-environmental behaviors [47].

Synodinos [48] argued that the improvement of consumers' sustainable consumption perceptions promoted positive attitudes towards the purchase behavior of sustainable products. Flamm [37] found that households with higher levels of sustainable consumption perceptions had a higher propensity to purchase fuel-efficient vehicles. Nevertheless, when individuals lack professional and specialized sustainability knowledge, they will easily be affected by cognitive biases of sustainable consumption [47], which enlarge the psychological distance between individuals and sustainable products. People's behavior will be inhibited, especially when they do not have sufficient motivation to overcome the barriers related to sustainable consumption behavior. It is deduced that individuals with higher sustainable consumption perceptions are more likely to perceive sustainable products' green efficacy and make purchase decisions based on rational thinking. Therefore, the following hypothesis is proposed.

**Hypothesis 1 (H1).** *Sustainable consumption perception (SCP) has a positive effect on efficiency behavior (EB).*

#### 2.4. The Mediating Effect of Lifestyle

Lifestyle (LS), as a concept system, refers to a distinctive mode of living in its broadest sense, embodying the patterns that develop and emerge from the dynamics of living in a society [60]. It describes individual activities and behavioral characteristics formed by the interaction of individuals with their social context; it is represented by their living statuses, patterns of activities, interests, and attitudes in which individuals dominate their time and energy, as well as the basic demographic characteristics of individuals. One lifestyle used in marketing is "how consumers live, and includes the products they purchase, how they consume, what they think, and how they feel toward them" [61]. Due to the differences in the allocation of time and effort spent on different product categories by different social groups, lifestyle is often used to identify and label them [62]. Cronin [63] argued that it was important to understand consumer behavioral characteristics that influenced sustainable consumption behavior, especially when a high price needed to be paid for sustainable products [64–66]. Thus, the acceptable product premium for consumers and the factors influencing purchase intention [67] are the key points of research.

The variability of lifestyles makes it challenging to measure lifestyles of different social groups using one method or one dimension, so scholars developed different dimensions to measure lifestyles for different research subjects and constructed the theoretical connotations with a broad multidimension. For instance, Chen [68] introduced a measure with four dimensions to evaluate lifestyle in the study of sustainable product purchasing

via a literature review: fashion concern, leadership concern, price concern, and attitude toward past concern. For the low carbonization of lifestyles, Sheng et al. [69] defined four dimensions comprising fashion concern, leadership concern, price concern, and development concern to measure consumer lifestyle. Regarding the strong connection between sustainable products, lifestyle decarbonization, and efficiency behavior in Chinese contexts, this study adopts Sheng's four-dimensional division of lifestyle. Among them, fashion concern (FC) means persons' perceptions and attitudes toward fashion, leadership concern (LC) reflects the ability to make independent decisions and influence others, price concern (PC) describes persons' sensitivity to product prices, and development concern (DC) refers to consumers' attitudes and perceptions of things from the past and the future.

Individuals' activities, interests, and attitudes displayed during their growth result from interactions between individuals and social factors. Such interactions between individuals and the external environment (e.g., culture, sub-culture, social class, reference groups, family members) make individuals acquire knowledge, information, and facts about sustainability, then develop sustainable consumption perceptions, which, in turn, affect the external environment and promote individuals and group lifestyle changes towards sustainability. Based on this, the following hypotheses are proposed.

**Hypothesis 2 (H2).** *Sustainable consumption perception (SCP) has an impact on lifestyle (LS).*

**Hypothesis 2a (H2a).** *Sustainable consumption perception (SCP) has an impact on fashion concern (FC).*

**Hypothesis 2b (H2b).** *Sustainable consumption perception (SCP) has an impact on leadership concern (LC).*

**Hypothesis 2c (H2c).** *Sustainable consumption perception (SCP) has an impact on price concern (PC).*

**Hypothesis 2d (H2d).** *Sustainable consumption perception (SCP) has an impact on development concern (DC).*

Lifestyle is an important factor influencing individuals' behaviors [69] and guiding people's attitudes and behaviors [70,71]. Research on green purchasing behavior shows that lifestyle plays an important role in explaining and predicting consumer preferences for green purchasing behavior [72,73], indicating a positive relationship between lifestyle and sustainable behavior patterns [74]. Laroche [75] argued that individuals with a higher environmental awareness are more likely to engage in environmentally friendly consumption. According to the "Knowledge, Attitude/Belief, Practice (KAP)" model, knowledge is the basis for attitude/beliefs, beliefs are the motivation for behavior change, and a certain progressive relationship exists among knowledge, attitude/beliefs, and practice. It can be inferred that the knowledge of sustainable consumption can motivate individuals to perceive and develop favorable beliefs about resource and environmental conservation and then promote efficient behaviors through adjusting their activities, interests, and attitude patterns related to sustainable consumption. Therefore, the following hypotheses are proposed.

**Hypothesis 3 (H3).** *Lifestyle (LS) has an impact on efficiency behavior (EB).*

**Hypothesis 3a (H3a).** *Fashion concern (FC) has an impact on efficiency behavior (EB).*

**Hypothesis 3b (H3b).** *Leadership concern (LC) has an impact on efficiency behavior (EB).*

**Hypothesis 3c (H3c).** *Price concern (PC) has an impact on efficiency behavior (EB).*

**Hypothesis 3d (H3d).** *Development concern (DC) has an impact on efficiency behavior (EB).*

**Hypothesis 4 (H4).** *In the presence of lifestyle (LS), sustainable consumption perception (SCP) has an influence on efficiency behavior (EB).*

**Hypothesis 4a (H4a).** *In the presence of fashion concern (FC), sustainable consumption perception (SCP) has an influence on efficiency behavior (EB).*

**Hypothesis 4b (H4b).** *In the presence of leadership concern (LC), sustainable consumption perception (SCP) has an influence on efficiency behavior (EB).*

**Hypothesis 4c (H4c).** *In the presence of price concern (PC), sustainable consumption perception (SCP) has an influence on efficiency behavior (EB).*

**Hypothesis 4d (H4d).** *In the presence of development concern (DC), sustainable consumption perception (SCP) has an influence on efficiency behavior (EB).*

### 2.5. Moderating Effect of Product Sustainability Perception

Product sustainability perception (PSP) refers to a comprehensive subjective perception and trust in product's green attributes. Green attributes stand for additional product attributes based on the original product attributes, such as energy saving, emission reduction, and recycling, aiming to satisfy consumers' multiple requirements in both product function and environmental benefit [76,77]. Green attributes upgrade the product's beneficial attributes and prompt people to generate positive emotions about green products and the ecological environment [75]. Although few studies on the relationship between sustainability perceptions and efficiency behavior were executed, the influence of green products and services on green consumption has been confirmed [78]. Yang et al. [79] argued that the fundamental reason Chinese consumers purchase green products is that they can perceive more environmental utility and environmental values from green products. This perception can directly help consumers to identify the green utility of environmentally friendly products and motivate them to make green purchasing decisions [63].

It is concluded that when people have a higher perception of sustainable consumption, they are inclined to actively search for information about sustainable products, compare and evaluate the environmental utility and environmental value of sustainable products, and then make sustainable product purchase decisions [73]. The perceived efficacy of sustainable products can promote and motivate efficiency behaviors to become more rational and objective [74], thereby boosting consumers' positive emotions toward sustainable products. This means that the perception of product sustainability significantly influences the relationship between the perception of sustainable consumption and efficiency behavior. Therefore, the following hypothesis is proposed.

**Hypothesis 5 (H5).** *Significant differences exist between lower and higher levels of product sustainability perception (PSP).*

### 2.6. Moderating Effect of Product Facility Supply Conditions

The supply conditions of products and facilities mean the availability of services, credibility, accessibility of sustainable products, and the sophistication and maturity of green technologies [80,81]. The "Social Practices Approach" advocates that sustainable consumption analysis should focus on the social practices engaged in and the reasons, interests, and motivations behind them, as well as the supply systems that constrain the practices [82]. The supply system refers to the technical system and infrastructures needed in the daily household management of the actor, which is closely related to the practice of consumption behavior. In order to ensure that the patterns of the design, production, and distribution on the supply side match the ways of acquisition, usage, and disposal on the

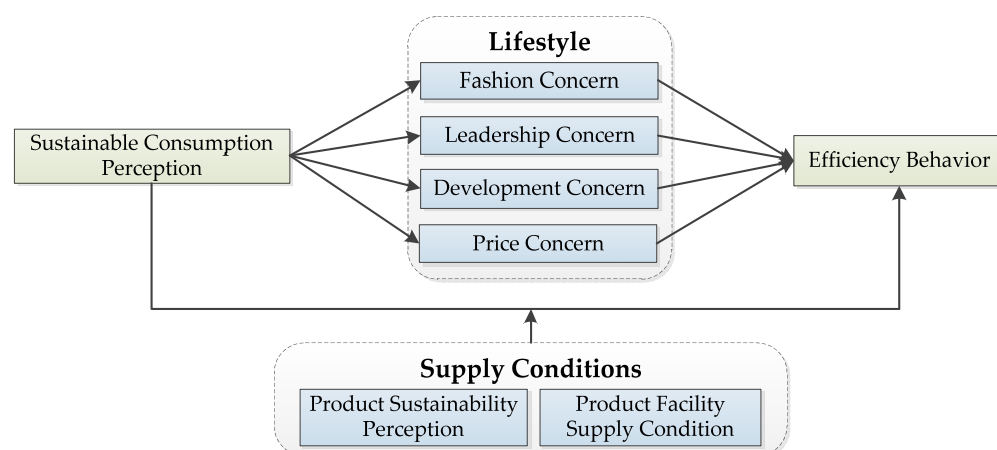
consumption side, and, in order to provide consumers with a specific configuration of choices [83], sustainable consumption, research should focus on both behavioral choices and the interrelationships between the configurations of choices developed in the supply system. In other words, it is necessary to increase the dissemination of knowledge and skills related to sustainable consumption practices among members of society, trying to inspire and guide them to shift to more environmentally friendly social practices and lifestyles. Meanwhile, it is essential to make more sustainable environmental technologies and infrastructures accessible at a larger societal level through institutional arrangements, i.e., to improve the level of the supply system.

It has been shown that the supply conditions of products and facilities influence consumers' sustainable product-purchasing intentions and behavior. Product availability, regarded as a major constraint that prevents consumers from purchasing sustainable products [84], positively affects consumers' purchase intentions [85]. The better transportation infrastructure provision has led to the higher efficiency of shared transportation and new energy vehicles in China. The existing findings indicate that the active participation of individuals and their abilities to practice sustainable consumption behaviors in the long term depend largely on technology development and the availability of facilities attached to sustainable products. Many countries in the world are adopting various incentives, such as subsidies for sustainable products and tax reductions for investments in energy-efficient facilities [51], aiming to encourage consumers to purchase sustainable products to expand their market shares and improve energy efficiency. Salo et al. [86] addressed the fact that technological product innovations were an important solution to the current sustainability challenges and the required systemic transformation. Eco-innovation technology could improve textile performance, reduce environmental impacts, and drive the development of a circular economy. Polzin et al. [87] argued that technological maturity facilitated energy efficiency retrofitting and energy performance, but this is translated into transaction costs, resulting in high perceived investment risks and long payback periods. Therefore, the technological innovation and maturity of a sustainable product not only affect its sales price, usage cost, convenience in use, and reliability, but also affect residents' confidence and willingness to purchase. In a study of new energy vehicles, Lim et al. [88] proposed that the effectiveness of the large-scale adoption of electric vehicles depended not only on technological innovation and other factors, but also on consumers' psychological willingness, the most fundamental psychological barrier was consumers' range anxiety [89], thus suggesting constructing more sustainable product infrastructure helped increase consumer willingness to consume. When the technology and auxiliary facilities related to sustainable products are better, the easier it is for consumers to perceive and reach sustainable products [90], which in turn increases consumer confidence in the practice and stimulates the occurrence of consumption behavior, raising the premium level of sustainable products [91]. Therefore, the following hypothesis is proposed.

**Hypothesis 6 (H6).** *Significant differences exist between lower and higher levels of product facility supply conditions (PFSC).*

In summary, a research model with sustainable consumption perception (SCP) as the independent variable, efficiency behavior (EB) as the dependent variable, lifestyle (LS) as the mediating variable, and product sustainability perception (PSP) and product facility supply conditions (PFSC) as the moderating variables is constructed as shown in Figure 1.



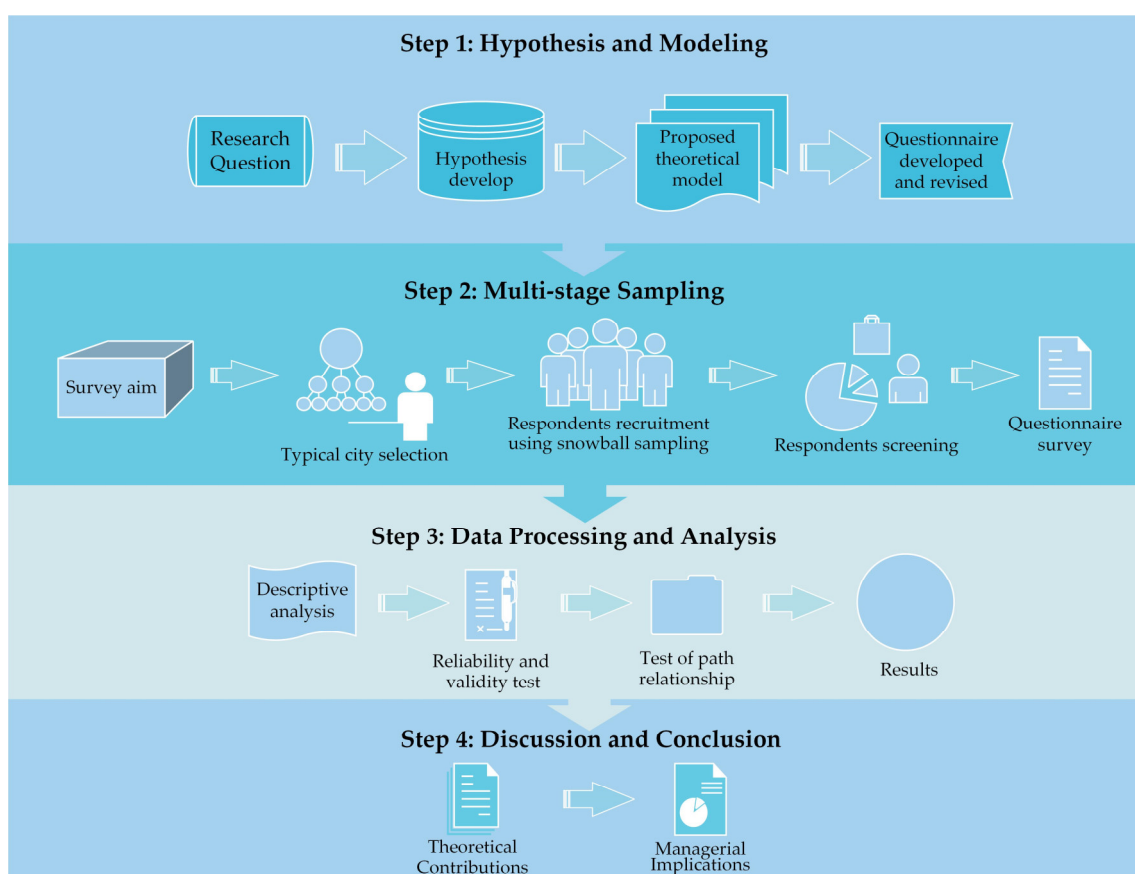


**Figure 1.** The proposed theoretical model.

### 3. Research Methodology

#### 3.1. Research Design

In line with the research aim described above, the research framework consists of four procedures (see Figure 2). Firstly, a comprehensive literature review was conducted in response to the research question for developing the hypotheses, research model, and instrument measurement. Next, the multistage sampling technique was adopted to ensure questionnaires targeting typical regions and populations in the context of China. Then, data processing and analysis were followed, including data cleaning, descriptive statistical analysis, reliability and validity analysis, correlation analysis, hypothesis testing, etc. Finally, the conclusions and suggestions will be put forward.



**Figure 2.** Research roadmap.

### 3.2. Questionnaire and Instrument Development

The theoretical model of this study contains a total of five instruments, all of which are latent variables that cannot be directly measured. Therefore, a structured self-administered questionnaire that is presented with multiple items developed from each instrument is adopted for obtaining the survey data in this study. The questionnaire comprises two main sections. The first section of the questionnaire aims to measure respondents' demographic information, such as gender, age group, education, and income. The second section captures residents' perception and the behavior of sustainable consumption, as well as the associated lifestyle and supply conditions.

In order to ensure the reliability and validity of the survey, the five constructs of sustainable consumption perception, lifestyle, efficiency behavior, product sustainability perception, and product facility supply conditions were considered based on the previous relevant studies. All questionnaire items were based on the established scales of related studies and were corrected through consultation with experts in this field. The respondents were invited to review and test them repeatedly until the questionnaire items were logical and rigorous. All items were measured with a Likert-type scale ranging from 1 = strongly disagree to 5 = strongly agree, with 3 indicating neither agree nor disagree. The revised questionnaire contains the following specific items. All measurement items can be found in Table A1 in Appendix A.

The independent variable "sustainable consumption perception" was measured based on the connotation of sustainable consumption [77]. Four items were designed, including the perception of the effectiveness of sustainable consumption, the perception of sustainable products, perception of the principle of fairness, and the perception of the channels to obtain knowledge about sustainable consumption. The dependent variable "efficiency behavior" mainly examined "the situation of being able to invest more money in sustainable products in the early stage, the situation of purchasing sustainable products within the limits of one's ability, and the situation of prioritizing the purchase of sustainable products".

The mediating variable "lifestyle" is introduced from the scale developed by Sheng et al., containing four dimensions: fashion concern, leadership concern, development concern, and price concern. The scale was extracted from previous research results and has been widely used in green low-carbon consumption research. Among them, "fashion concern" includes "the status of owning the most updated clothing, the status of accepting new functional and technologically innovative products, and attention to innovative new fashion topics, as well as the acceptance of fashion, popular things, or purchasing innovative products". "Leadership concern" consists of the following four items: "self-confidence of the individual compared to the majority of the population, ability to make independent decisions, personal charisma and capability to lead fashion, and influence others around him/her to accept innovative ideas and things". "Development concern" involves four issues: "Not wanting to be like the past, technological progress will make life better and better, prefer to buy and use green products for protecting the ecological environment, and are inclined to recycle waste materials to promote harmony between human beings and nature", and "price concern" includes the following four issues: how much attention they pay to discount and promotion advertisements, whether they "shop around" when shopping, and whether they prefer to pay higher prices for high quality goods or green goods.

The moderating variable "product sustainability perception" mainly focuses on the following four items, containing "the technical maturity and stability of sustainable products, the adequacy of ancillary facilities and after-sales services, the priority given to environmentally friendly products, and the low energy consumption of home appliances or automobiles with the same performance". The moderating variable, "product facility supply conditions", covers three items, including "the convenience of purchasing the required sustainable products, the adequacy of ancillary facilities for sustainable products in real life, and the availability of convenient waste separation bins and channels in life".

To evaluate the face and content validity of the initial questionnaire, ten experts (university scholars and enterprise managers) were recruited to review the questionnaire. The aim was to obtain some comments on the applicability and clarity of the items and suggest any key items that might be unclear or missing. The revised version of the questionnaire was reached after minor amendments based on their comments. Finally, a small-scale pilot test ( $n = 150$ ) aiming to evaluate the clarity of the questionnaire was conducted, and 142 were returned. The results showed that the Corrected Item–Total Correlation (CITC) of one item (not wanting to be like the past) is 0.149, below the critical value of 0.4, so this item was deleted. At last, the reliability and validity of the scale passed the test; it was eligible to proceed to the formal questionnaire.

### 3.3. Sampling Technique and Data Collection

The formal questionnaire was carried out during January–June 2021, and all questionnaires were anonymous. The target population is permanent residents living in medium-sized cities and above in China (residing for more than one year). To achieve sufficient representation of the target population in the survey, the questionnaire was conducted using a multi-stage sampling technique.

In the first stage, considering the influence of the urbanization level and economic growth on residents' perceptions and behaviors, we adopted the economic geography division method, which is widely adopted in China's economic research [92]; 12 relatively large-scale cities with good economic development in the eastern (Beijing, Tianjin, Shanghai, Guangzhou, Shenzhen, etc.), central (Zhengzhou, Wuhan, Taiyuan, Changsha, etc.), and western (Xi'an, Lanzhou, Urumqi, etc.) parts of China were selected. That is because these cities are relatively well developed along economic lines, and, with better sustainability products and their supporting measures, residents have a certain awareness and understanding of sustainability.

In the second stage, subjects within the cities specified above were recruited via a snowball sampling technique. Due to the COVID-19 pandemic in 2021, it is difficult to conduct field research. Snowball sampling via WeChat, which is the most popular mobile social networking platform in China [93] with more than three billion daily active users by the end of 2019 [94], would be the best choice for this study. Meanwhile, using WeChat to distribute the survey is not only cost-effective to achieve a higher response rate [95], but also, more importantly, to provide maximum reach to eligible subjects within the specified cities. The invitation to respondents was shared via WeChat with a link to the survey. The goal was to have relatively equal sample sizes for the three economic belts, and the snowball sampling method limits the potential to control the number of subjects recruited from each district.

Additionally, to ensure that the participants are familiar with sustainability, a one-screening question was added to the survey to ask about their experience of purchasing sustainable products (such as green food, green clothing, new energy electric vehicles, high-efficiency laundry machines, etc.) in daily life. During the actual process of the questionnaire, we adopted some incentive approaches to ensure a higher response rate. One way was to distribute the proposed survey through friends' recommendations via WeChat, and the other way was to assign a specific amount of money to the interviewees via random allocation by means of WeChat's online payment function. Eventually, a total of 2200 questionnaires were collected, of which 186 questionnaires were deleted because of random completion or apparently illogical answers to questions; 2014 valid questionnaires were retained and used for subsequent data analysis. The effective recovery rate was 91.5%.

#### 4. Empirical Analysis

According to the research aim and the proposed model, the SPSS and AMOS are used for hypothesis testing in this study. Specifically, a frequency analysis was performed for the demographic analysis, a reliability analysis was conducted to evaluate the reliability of survey questions, and a factor analysis was used to assess the validity of survey questions. A correlation analysis was performed to evaluate the strength of the relationship between variables. Finally, a structural equation analysis was performed to identify the structural relationship between measured variables.

As shown in Table 1, the sample consisted of 45.08% males and 54.92% females. The education level was 32.08% below senior high school, 54.37% university (including college), and 13.56% Master's degree and above. It is noteworthy that respondents born in or after 1995 or those with higher education each account for a larger proportion of the survey sample. This is understandable, because, of groups containing a larger number of respondents born in or after 1995, representing about 280 million people in China [96], and respondents with a higher education (college and above), holding a higher level of awareness, knowledge, skills, and values needed to approach sustainability issues [97], most engaged in efficiency behaviors, consequently more of them pass the filtered question items during the sampling process. In particular, the post-95 cohort in China, broadly known as Generation Z, which is largely highly educated due to their better family financial conditions [98]. They are more knowledgeable about sustainable living and give more priority to sustainable products compared to other generations [99], which is considered to the most motivated, potential, and influential generation among all generations in terms of sustainable consumption. According to a Global Health and Wellness Survey covering 30,000 people in 60 countries conducted by Nielsen (2015) [100], 41% of Generation Z are willing to pay a premium for foods they consider healthier, contributing the maximum market share to sustainable products, which is significantly higher than other generational cohorts (about 32% of Millennials, 21% of Baby Boomers). Thus, it can be concluded that the post-95 with higher education will be the leaders in sustainable consumption, playing a significant pilot leadership role for other generations. Then, the survey sample in this study is basically consistent with the classification ratio of the sustainable consumption population in China, which is representative to a certain extent. It has important implications for the Chinese future sustainable consumption market.

**Table 1.** Summary of the demographic characteristics of respondents.

Variable	Category	Frequency	Percent
Gender	Male	908	45.08%
	Female	1106	54.92%
Age Categories	Before 1960	269	13.36%
	1960–1982	648	32.17%
	1983–1994	303	15.04%
	After 1995	794	39.42%
	Large and medium-sized cities in the east	595	29.50%
Location of Residence	Large and medium-sized cities in the middle	566	28.10%
	Large and medium-sized cities in the west	635	31.50%
	Others	218	10.80%
Education	Elementary school and below	300	14.90%
	Senior high school	346	17.18%
	Junior college and Bachelor's degree	1095	54.37%
	Master's degree and above	273	13.56%
Monthly Income	Less than 3000 RMB Yuan	862	42.80%

3001–6000 RMB Yuan	277	13.75%
6001–10,000 RMB Yuan	305	15.14%
10,001–15,000v	313	15.54%
5000 RMB Yuan and more	257	12.76%
Total Number	2014	100.00%

#### 4.1. Common Method Biases Test

The Chinese urban residents' efficiency behavior model proposed in this paper serves as a multivariate analysis model involving five variables, including sustainable consumption perception, lifestyle, product sustainability perception, product facility supply conditions, and efficiency behavior. The approach of using a single questionnaire self-assessment in the research may lead to common-method bias [101], so anonymous surveys and decreasing semantic ambiguity were adopted to minimize the threat of common method bias (CMB). In order to further improve the rigor of the study, the Harman single-factor test was used to test the deviation of the common method before data analysis.

By means of SPSS22.0 statistical analysis software, the result of Harman's one-factor test showed that the total explained variance was 68.484%, and the explained variance of the first factor was 24.896% of the total variance less than 50% [102], indicating no one factor accounted for the majority of the variance. In addition, the single-factor model fit was very poor ( $\chi^2/df = 53.1253$ , CFI = 0.438, NFI = 0.434, NNFI = 0.3956, and RMSEA = 0.161), indicating there was no serious common method bias in this study.

#### 4.2. Reliability and Validity Test

Before testing the model and the hypotheses, it is necessary to perform a reliability test to examine the measured variables' consistency. Reliability is defined as the variance of measured values when the same concept is measured repeatedly. Cronbach's alpha ( $\alpha$ ) is generally used to measure reliability, that is, how closely a set of two or more predictor variables fit together as a group, with the confidence interval for the alpha coefficient ranging from 0 to 1. As shown in Table 2, the Cronbach's alpha ( $\alpha$ ) of sustainable consumption perception, fashion concern, leadership concern, development concern, price concern, efficiency behavior, product sustainability perception, and product facility supply condition are 0.908, 0.896, 0.876, 0.837, 0.843, 0.880, 0.822, and 0.850, respectively. All are higher than the acceptance criteria of 0.7. The results show that the data of this sample have good reliability.

Convergent validity refers to the consistency of observation variables that measure latent variables, which are evaluated by standardized factor loading and significance, average variance extracted (AVE), and construct reliability (CR). Among them, The AVE reflects the amount of variance captured by the construct in relation to the amount of variance due to measurement error. To achieve convergent validity, the standardized factor loading should be at least 0.5, but ideally 0.7 or higher, and the construct reliability (CR) should also be at least 1.965. An AVE of at least 0.5 and a construct reliability of 0.7 or higher are acceptable criteria for confirming the convergent validity [103]. In this study, the construct reliability estimates of all constructs exceeded the recommended threshold of 0.7, indicating that the measures are reliable. The AVE was greater than 0.5, indicating that each measurement model construct has good convergent validity.

Table 2. Reliability and validity test.

Variables	Manifest Variable	Unstd.	S.E.	Z	p-Value	Std.	Cronbach's Alpha ( $\alpha$ )	Composite Value (CR)	AVE
Sustainable Consumption Perception (SCP)	SCP1	1	-	-	-	0.835	0.908	0.908	0.712
	SCP2	1.011	0.022	46.207	0	0.857			
	SCP3	1.042	0.022	46.741	0	0.864			
	SCP4	0.972	0.023	43.078	0	0.817			
Fashion Concern (FC)	FC1	1	-	-	-	0.794	0.896	0.897	0.684
	FC2	1.038	0.026	39.744	0	0.818			
	FC3	1.011	0.024	42.099	0	0.858			
	FC4	1.014	0.025	40.922	0	0.838			
Leadership Concern (LC)	LC1	1	-	-	-	0.781	0.876	0.876	0.639
	LC2	0.987	0.028	35.334	0	0.769			
	LC3	1.039	0.028	37.388	0	0.809			
	LC4	1.073	0.028	38.639	0	0.836			
Development Concern (DC)	DC2	1	-	-	-	0.752	0.837	0.838	0.634
	DC3	1.046	0.03	34.71	0	0.837			
	DC4	1.012	0.03	33.645	0	0.797			
Price Concern (PC)	PC1	1	-	-	-	0.731	0.843	0.843	0.572
	PC2	1.013	0.032	31.236	0	0.765			
	PC3	1.013	0.032	31.228	0	0.765			
	PC3	1.030	0.033	31.231	0	0.765			
Efficiency Behavior (EB)	EB1	1	-	-	-	0.836	0.88	0.88	0.711
	EB2	0.983	0.023	42.778	0	0.841			
	EB3	1.071	0.025	43.312	0	0.852			
Product Sustainability Perception (PSP)	PSP1	1	-	-	-	0.784	0.822	0.823	0.608
	PSP2	0.964	0.026	37.027	0	0.778			
	PSP3	0.920	0.025	36.914	0	0.776			
Product Facility Supply Condition (PFSC)	PFSC1	1	-	-	-	0.721	0.850	0.854	0.594
	PFSC2	1.126	0.033	34.144	0	0.802			
	PFSC3	1.130	0.034	33.598	0	0.789			
	PFSC4	1.126	0.034	32.729	0	0.768			

Discriminant validity refers to a construct that is truly distinct from other constructs in terms of how much it correlates with others and how distinctly measured variables represent only this single construct. A more rigorous test compares the average variance-extracted values for any two constructs with the square of the correlation estimate between these two constructs. The variance-extracted estimates should be greater than the squared correlation estimate. As shown in Table 3, the square root of the AVE of each construct was higher than the correlations between each construct and the other constructs in the conceptual model, indicating that each construct is statistically different from the others [103]. All constructs in this study possessed high discriminant validity.

The model fit was tested with the help of AMOS 21.0 software. Results revealed that  $\chi^2 = 1842.996$ ,  $df = 349$ ,  $RMSEA = 0.046$ , less than 0.05. GFI, NFI, CFI all reach the standard of 0.9.  $\chi^2/df = 5.281$ , indicated an overall fitness of the model. Each value depicted meets the general research standards, so it can be considered that this model is a good fit for the empirical data.

**Table 3.** Discriminatory validity test of latent variables.

Variables	SCP	FC	LC	DC	PC	EB	PSP	PFSC
Sustainable Consumption Perception (SCP)	<b>0.844</b>							
Fashion Concern (FC)	0.233	<b>0.826</b>						
Leadership Concern (LC)	0.232	0.480	<b>0.799</b>					
Development Concern (DC)	0.420	0.293	0.293	<b>0.794</b>				
Price Concern (PC)	0.287	0.262	0.231	0.398	<b>0.756</b>			
Efficiency Behavior (EB)	0.361	0.268	0.233	0.430	0.391	<b>0.843</b>		
Product Sustainability Perception (PSP)	0.386	0.282	0.289	0.455	0.387	0.504	<b>0.785</b>	
Product Facility Supply Condition (PFSC)	0.206	0.202	0.202	0.273	0.330	0.388	0.734	<b>0.809</b>

#### 4.3. Direct Path Relationship Test

Multiple regression methods using SPSS22.0 software are applied to test the direct relationships between sustainable consumption perceptions and lifestyle, lifestyle and efficiency behavior, and sustainable consumption perceptions and efficiency behavior, respectively. As shown in Table 4, sustainable consumption perception ( $\beta_{SCP} = 0.172$ ,  $p = 0.000$ ) shows significant positive effects on efficiency behavior; Hypothesis H1 was supported. Sustainable consumption perception positively and significantly affects the four dimensions of lifestyle ( $\beta_{FC} = 0.250$ ,  $p = 0.000$ ;  $\beta_{LC} = 0.227$ ,  $p = 0.000$ ;  $\beta_{DC} = 0.400$ ,  $p = 0.000$ ;  $\beta_{PC} = 0.265$ ,  $p = 0.000$ ), accordingly, Hypotheses H2, H2a, H2b, H2c, and H2d were supported. Among the effects of lifestyle on efficiency behavior, fashion concern ( $\beta_{FC} = 0.081$ ,  $p = 0.000$ ), development concern ( $\beta_{DC} = 0.249$ ,  $p = 0.000$ ), and price concern ( $\beta_{PC} = 0.235$ ,  $p = 0.000$ ) positively affect efficiency behavior. Conversely, the leadership concern ( $\beta_{LC} = 0.033$ ,  $p = 0.149 > 0.05$ ) on efficiency behavior influence was not confirmed, so Hypotheses H3a, H3c, and H3d were supported, while Hypothesis H3b is not supported. So, Hypothesis H3 was partially supported.

**Table 4.** Results of direct-path relationship test.

Variables	FC	LC	DC	PC	EB
Sustainable Consumption Perception (SCP)	0.250 **	0.227 **	0.400 **	0.265 **	0.172 **
Fashion Concern (FC)					0.081 **
Leadership Concern (LC)					0.033
Development Concern (DC)					0.249 **
Price Concern (PC)					0.235 **

Note: \*\* Correlation is significant at the 0.01 level (two-tailed test).

#### 4.4. Mediation Test

For the four dimensions of lifestyle, the proposed research model involves four mediating paths between sustainable consumption perception and efficiency behavior. A bootstrapping confidence interval test was used to test the mediation effect. The bootstrap sampling was set 5000 times to examine whether the 95% confidence interval included zero. When it does not include zero, the mediation effect exists and vice versa.

Results are shown in Table 5. Among them, the mediation path of leadership concern (−0.006, 0.017) is not significant and hypothesis H4b is not supported. While the mediation paths of the fashion concern (0.005, 0.039), development concern (0.073, 0.131), and price concern (0.046, 0.089) are significant, hypotheses H4a, H4c, and H4d are supported. Thus, the significant mediating effects of the three dimensions of lifestyle (i.e., fashion concern,

development concern, and price concern) were found between the sustainable consumption perception and efficiency behavior. Hence, hypothesis H4 is partially valid.

**Table 5.** The mediating effect of Bootstrapping.

Hypotheses	Hypothesized Path	<i>p</i> -Value	<i>a</i> × <i>b</i> (95% BootCI)	<i>c'</i> Direct Effect	Results
H4a	SCP→FC→EB	0.010	0.005~0.039	0.172 **	Partial Mediation
H4b	SCP→LC→EB	0.203	−0.006~0.017	0.172 **	Rejected
H4c	SCP→DC→EB	0.000	0.073~0.131	0.172 **	Partial Mediation
H4d	SCP→PC→EB	0.000	0.046~0.089	0.172 **	Partial Mediation

Note: \*\* Correlation is significant at the 0.01 level (two-tailed test).

#### 4.5. The Moderating Effect Test

The hierarchical regression was applied to verify the moderating role of product sustainability perceptions and product facility supply conditions. The results (see Table 6) show that the sustainable consumption perception in model 1 significantly predicted efficiency behavior, the product sustainability perception in model 2 positively predicted efficiency behavior, the interaction term between sustainability perception and product sustainability perception in model 3 was significant ( $t = 21.757$ ,  $p = 0.000 < 0.05$ ), and the model explanatory strength  $R^2$  (0.304) of model 3 was greater than that of (0.287) model 2. This proves that the model fit is greater than that of the interaction term before it enters the regression equation, showing the moderating role of product sustainability perception between sustainable consumption perception and efficiency behavior; then, hypothesis H5 is confirmed. Similarly, the results (see Table 7) support Hypothesis H6, indicating the moderating effect of product facility supply conditions.

**Table 6.** Moderating effect of product sustainability perceptions.

Regression Equation ( <i>n</i> = 2014)	Model 1	Model 2	Model 3
SCP	3.671 ** (182.464)	3.671 ** (201.551)	3.632 ** (192.546)
PSP	0.362 ** (17.391)	0.201 ** (9.892)	0.238 ** (11.442)
SCP × PSP		0.463 ** (21.070)	0.474 ** (21.757)
$R^2$	0.13	0.287	0.304
F	F (1, 2012) = 302.449	F (2, 2011) = 406.500	F (3, 2010) = 293.420

Note: \*\*  $p < 0.01$ ; *t* value in brackets.

**Table 7.** Moderating effect of product facility supply conditions.

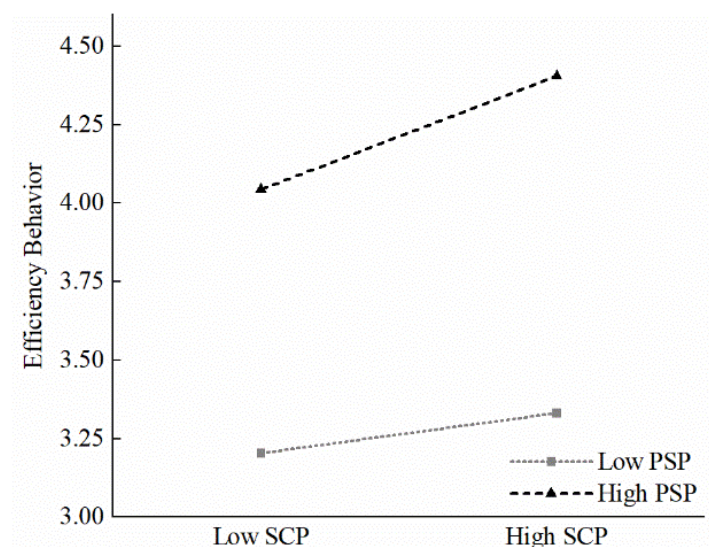
Regression Equation ( <i>n</i> = 2014)	Model 1	Model 2	Model 3
SCP	3.671 ** (182.464)	3.671 ** (196.399)	3.647 ** (192.179)
PFSC	0.362 ** (17.391)	0.268 ** (13.364)	0.290 ** (14.347)
SCP × PFSC		0.377 ** (17.890)	0.385 ** (18.380)
$R^2$	0.131	0.25	0.263
F	F (1, 2012) = 302.449	F (2, 2011) = 335.239	F (3, 2010) = 238.724

Note: \*\*  $p < 0.01$ ; *t* value in brackets.

Finally, the decomposition of the moderating effects of the product sustainability perception and product facility supply conditions between sustainable consumption perception and efficiency behavior are analyzed, respectively, by a simple slope test. As illustrated in Figure 3, for subjects with lower ( $M-1SD$ ) and higher ( $M+1SD$ ) levels of product sustainability perception, sustainable consumption perception has a significant positive predictive effect on efficiency behavior. Still, the positive predictive effect is stronger for subjects with higher ( $M+1SD$ ) levels of perception, indicating that, as the level of product sustainability perception increases, sustainable consumption perceptions are more likely to promote efficient behavior by enhancing individuals' perceptions of product

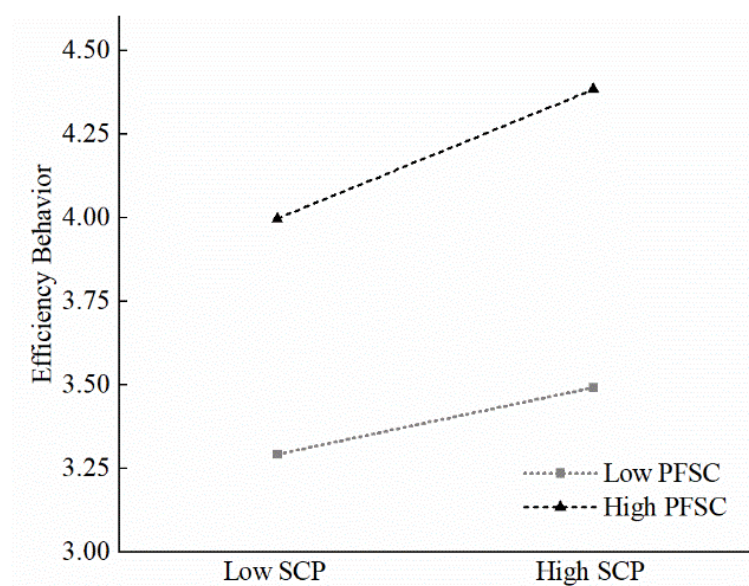


sustainability. As the level of product sustainability increases, the perception of sustainable consumption is more likely to enhance individuals' perception of product sustainability and thus promote efficiency behavior.



**Figure 3.** Moderating effect of PSP.

As shown in Figure 4, the positive predictive effect of sustainable consumption perception on efficiency behavior is also significant for subjects with lower (M-1SD) and higher (M+1SD) levels of product facility supply conditions, as well as the positive predictive effect is significantly more substantial for subjects with higher levels of product facility supply conditions, indicating that, as the level of product facility supply conditions increases, sustainable consumption perception are more likely to influence consumer behavior through increased product facility supply conditions. The positive predictive effect of the higher level of product facility supply conditions is also significant.



**Figure 4.** Moderating effect of PFSC.

Table 8 provides a summary of all the proposed hypotheses in this study, and their implications for sustainability theory and practice are discussed in the following section.

**Table 8.** Results of the proposed hypotheses test.

Hypotheses	Hypothesized Path	$\beta$	<i>p</i> -value	<i>a</i> × <i>b</i> (95% BootCI)	Results
H1	SCP→EB	0.172	0.000	-	Supported
H2	SCP→LS	-	-	-	Supported
H2a	SCP→FC	0.250	0.000	-	Supported
H2b	SCP→LC	0.227	0.000	-	Supported
H2c	SCP→DC	0.400	0.000	-	Supported
H2d	SCP→PC	0.265	0.000	-	Supported
H3	LS→EB	-	-	-	Partially supported
H3a	FC→EB	0.081	0.000	-	Supported
H3b	LC→EB	0.033	0.149	-	Rejected
H3c	DC→EB	0.249	0.000	-	Supported
H3d	PC→EB	0.235	0.000	-	Supported
H4	SCP→LS→EB	-	-	-	Partially supported
H4a	SCP→FC→EB	-	-	0.005~0.039	Supported
H4b	SCP→LC→EB	-	-	-0.006~0.017	Rejected
H4c	SCP→DC→EB	-	-	0.073~0.131	Supported
H4d	SCP→PC→EB	-	-	0.046~0.089	Supported
H5	SCP × PSP→EB	0.136	0.000	-	Supported
H6	SCP × PFSC→EB	0.115	0.000	-	Supported

## 5. Discussion

The sustainability consumption perception of Chinese urban residents has experienced significant growth during the last several years. However, the problem of insufficient perception of sustainable consumption and the “perception-action paradox” still exist, which is not consistent with the sustainability paradigm and hardly responds to the socio-economic and environmental challenges. This study first introduces a holistic perspective, which is in line with that of Gilg et al. [104] in a study of environmental action in and around the home, to analyze the relationship between urban residents’ perceptions of sustainable consumption and their lifestyles and efficiency behaviors, as well as the influencing mechanisms. We think efficiency behavior must be investigated in a broader context, including the internal and external factors of the individual. Based on the research in this study, the following findings were obtained.

Firstly, the significant effect of the sustainable consumption perception on lifestyle (H2) and efficiency behaviors (H1) is further confirmed. Sustainable consumption perceptions are implicit values of urban residents and influence attitudes and intentions of pro-environmental behaviors, which are the antecedent variables of lifestyle and efficiency behaviors. The results reveal that profound sustainable consumption perception drives efficiency behavior directly and has positive effects on lifestyle, which is consistent with the results obtained by Flamm [37] and Wang [105]. Notably, this study explores the significant positive effect of sustainable consumption perceptions on lifestyle dimensions and finds differences amongst them, with the magnitude of the positive predictive effect ordered as: development concern (H2d) > price concern (H2c) > fashion concern (H2a) > leadership concern (H2b). To our knowledge, this finding has not been reported in previous studies, indicating that the improvement of urban residents’ sustainable consumption perceptions is conducive to significant advances in lifestyle and efficiency behavior, especially in the two dimensions of development concern and price concern.

Secondly, how each lifestyle dimension affects efficiency behavior (H3) and whether it mediates between perceptions of sustainable consumption and efficiency behavior (H4)

are explored. To our best knowledge, the division of lifestyle dimensions and the deep-seated mediation effect of each dimension on efficiency behavior have not been discussed in the existing literature. In terms of the direct effect of lifestyle on efficiency behavior, all three dimensions except leadership concern (H3b), namely, fashion concern (H3a), price awareness (H3c), and development concern (H3d), positively influence efficiency behavior, and their magnitudes increase successively. In particular, for the indirect effect of lifestyle we found in this study, the three dimensions including fashion concern (H4a), price concern (H4c), and development concern (H4d) serve as a significant mediator between perceptions of sustainable consumption and efficiency behavior, and the mediating effects increase in order, whereas the leadership concern (H4b) does not have a significant mediating effect. The results show that the main dimension of lifestyle affects efficiency behavior, indicating that fostering urban residents with positive developmental concern, rational price concern, and good fashion concern is crucial in promoting efficient behaviors. This will provide direction and guidance for policymaking regarding incentives for efficient behavior.

In addition, the positive moderating role of perceived product sustainability and product facility supply conditions between the perception of sustainable consumption and efficiency behavior is concluded. The results suggest that urban citizens' efficiency behavior is guided by perceived product sustainability information and motivated and facilitated by good product facility availability levels. Regarding the positive effect of the sustainable consumption perception, it is consistent with the effect of "Green trust" proposed by Hossain [75]. Individuals with higher levels of sustainable consumption perceptions are more likely to foster environmental and social responsibility, as well as to perceive the sustainability of green products and the convenience of facilities. Consequently, their perception of eco-efficiency and trust in sustainable products will be enhanced, and the barriers to high-cost actions will be reduced. In other words, both product sustainability perception (H5) and product facility availability conditions (H6) have a significant positive moderating effect on the relationship between sustainability perception and efficiency behaviors. All findings broaden the micro perspective of previous consumer-behavior studies and provide a holistic perspective that integrates micro and macro perspectives to understand why efficiency behaviors happen.

## 6. Theoretical Contributions and Implications

This study contributes to innovative theoretical approaches for implementing sustainable development strategies in response to the Chinese industrial development and ecological conservation requirements. The findings broaden the theoretical perspective of efficiency behavior research, discover the further influencing mechanism of urban residents' efficiency behavior, and enrich the theoretical basis of sustainable consumption research in the Chinese context.

Based on these findings, the following implications are proposed to guide Chinese governments in promoting sustainable consumption practices and to provide references for sustainable consumption promotion in other countries worldwide.

Firstly, it is of foremost importance to improve the level and depth of urban residents' knowledge of sustainable consumption through consumer education. Only through the purposeful and planned dissemination of professional and specialized sustainable knowledge to urban residents can we effectively enhance the depth and level of urban residents' knowledge of sustainable consumption, strengthen consumers' belief in environmental responsibility, and develop sustainable consumption skills and qualities. It is necessary to establish a comprehensive education system for sustainable consumption; to integrate education on green priority and sustainable consumption into the family, school, and social education throughout the different stages of life; and to form a continuous, normal, and lasting education on consumption. Consumer education should be guided by innovative cultural values and should constantly update the content of consumer education and cultivate individual perception, awareness of resource concerns, and

environmental protection. The aim is to enhance urban residents' principal responsibilities, including self-awareness, self-restraint, and self-construction of sustainable consumption, and to urge urban residents to correctly coordinate and handle the relationships among individuals, families, and society.

Secondly, it is essential to guide the low-carbon transformation of urban residents' lifestyles through policy incentives, institutional constraints, and social norms. As Revell [106] pointed out, the sustainable transformation of consumerism-oriented lifestyles involves a series of complex internal and external factors and psychological transformation mechanisms, including urban residents themselves, as well as the social environment. Given the significant positive direct and indirect effects of development concern and price concern on efficiency behavior, the government needs to reinforce the guidance of urban residents' lifestyle construction through publicity and legislation, rationalize urban residents' purchasing decisions through policy incentives such as price subsidies, and cultivate urban residents' development concern and price concern through self-regulation. In this process, it is essential to pay attention to the impact of the reference groups (such as spouses, other family members, or idols.), which are considered a significant influence factor in consumers' choices due to the face perception of Chinese consumers [107]. On the other hand, the role of opinion leaders in the whole consumers' lifestyle cannot be ignored. In short, consumers' choices and corporate behaviors should be guided silently, converting the "default option" (using unconscious intuitive thinking) into a conscious and voluntary intuitive choice in daily life.

Thirdly, it is urgent to build a closed-loop system of sustainable consumption, containing the production, supply, consumption, and usage [84] of sustainable products, and to improve the sustainable perception of products and the supply level of supporting facilities for urban residents. Primarily, enterprises should take full responsibility to build a market-oriented sustainable technology innovation system, overcome technical bottlenecks in sustainable product development, and reduce the premium level of sustainable products, in addition to further improving the supply conditions of sustainable products for the whole society. At the same time, sustainable information communication related to sustainable products should be strengthened by green labels, to improve urban residents' confidence and attitudes toward green products, and fully realize the leading role of enterprises in sustainable development. In addition, it is necessary to combine government, enterprises, society, and urban residents, through policy incentives, enterprise demonstrations, social advocacy, and other multifaceted initiatives, to strengthen the infrastructure construction and support investment in sustainable products, enhance the allocation efficiency of social resources through digital technology tracking and feedback, and reduce the complexity and intimidation of urban residents to engage in sustainable consumption practices, especially for the current weak links and areas of sustainable consumption.

## 7. Conclusions and Research Limitations

This study investigates the relationship between sustainable consumption perception and efficiency behaviors and the associated influence mechanisms in the Chinese context. An important contribution of this research is the construction of a holistic research framework, which integrates micro and macro levels based on the "Social Practice Approach", with lifestyle as the mediating variable, and supply conditions as the moderating variable. We examine the direct and indirect effect of the sustainable consumption perception on the efficiency behaviors of Chinese urban residents. Our results reveal that the sustainable consumption perception exerts a significantly positive influence on the four lifestyle dimensions and efficiency behaviors. Significant differences are explicitly identified among the four dimensions of lifestyle on efficiency behavior and the mediating effect between sustainable consumption perception and efficiency behaviors, especially the development and price dimensions. We have observed that significant differences exist between lower and higher levels of product sustainability perception and product facility availability

conditions. The most interesting part of these results is the findings related to the four dimensions of lifestyle and their deep-seated mediation effect on efficiency behavior.

This study still has some limitations. Firstly, the survey was conducted among urban residents mainly from twelve representative cities in eastern, central, and western China. Future studies are expected to consider city differences and the non-equivocal economic development among regions. Secondly, this study substantially depended on self-reported questionnaires via the WeChat App and was restricted to a larger random sample of respondents, and future research could be expected to gradually carry out field investigation and shed more light on the efficiency behavior of urban citizens. In addition, on the path of the relationship between the sustainable consumption perception and efficiency behavior, more variables are expected to be included so as to obtain a deeper understanding of the relationship and influence mechanisms. Therefore, future studies could explore a richer comparative study among different regions in China throughout field investigation and discover more variables that may affect the efficiency behavior, to provide implications and references for sustainable development in China and other countries.

**Author Contributions:** J.L. (Jianfang Liang) developed the research idea and wrote the manuscript. R.W. processed some information and data. J.L. (Jingjun Li) wrote the draft manuscript. All authors have read and agreed to the published version of the manuscript.

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## Appendix A

**Table A1.** Measurement items.

Variables		Manifest Variable	References
Sustainable Consumption Perception (SCP)	SCP1	Sustainable consumption enables both resource conservation and environmental protection.	Lo, H.-W. et al. [28], Annunziata A. et al. [57], Zia, A. et al. [77]
	SCP2	Green products emphasize the conservation and recycling of resources, environmental protection and human health.	
	SCP3	The principle of fairness of sustainable consumption is manifested both between individuals within the same generation and between different generations.	
	SCP4	I learn about sustainable knowledge through various channels such as the government, production enterprises, distribution agencies, and advertisements.	
Fashion Concern (FC)	FC1	I always own the most updated clothing.	Chen [68]; Sheng, G. et al. [69]
	FC2	I usually make an effort to adopt new functional and technologically innovative products.	
	FC3	I often pay attention to innovative fashion topics and discuss them with my friends.	
	FC4	I am always in touch with fashion and trends or buying innovative products earlier than others around me.	
Leadership Concern (LC)	LC1	I am more self-confident than the majority of people.	
	LC2	I am more inclined to make independent decisions than the majority of people.	

Development Concern (DC)	LC3	I own a charming personality and the ability to lead fashion.	
	LC4	I can influence people around me to accept innovative ideas and things.	
	DC1	I don't want to be the same as before.	
	DC2	Technological progress will make our life better and better.	
Price Concern (PC)	DC3	I prefer to buy and use green products for protecting the ecological environment.	
	DC4	I prefer to recycle waste materials to promote harmony between people and nature.	
	PC1	I often pay attention to discounts and promotional ads.	
	PC2	I always "shop around" when shopping.	
Efficiency Behavior (EB)	PC3	I prefer to pay a higher price for quality goods.	
	PC3	I prefer to pay a higher price for green products rather than conventional ones.	
	EB1	I prefer to invest more money in sustainable products to begin saving energy in the future.	
	EB2	I purchase green products within what I can afford.	
Product Sustainability Perception (PSP)	EB3	I give priority to green products such as new-energy cars.	Stern, P. et al. [30], Karlin, B. et al. [31], Baldini, M. et al. [32]
	PSP1	I care about the technological maturity and stability of green products (e.g., new energy vehicles, energy-efficient home appliances, green clothing, etc.)	
	PSP2	I would give preference to an eco-friendly product with the same performance, even if it costs more.	
	PSP3	I value low energy consumption when buying electrical appliances or vehicles.	
Product Facility Supply Condition (PFSC)	PFSC1	I care about the adequacy of ancillary facilities and after-sales service for sustainable products in real life.	Taki, A. et al. [76], Zia, A. [77]
	PFSC2	Most people can purchase the green products they need in a convenient way.	
	PFSC3	The ancillary facilities of green products in my daily life (e.g., new energy vehicles) are well equipped in real life.	
	PFSC4	There are convenient facilities and channels for recycling used and waste materials in daily life.	

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