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Original Paper

Analysis of Influencing Factors of Low-carbon Purchases

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Abstract

Social norms are informal rules that govern group behavior and are a powerful motivator for the formation of low-carbon purchasing habits. Based on SOR theory, this study conducts a questionnaire survey on 499 consumers and uses social norms, future orientation, Perceived Consumer Effectiveness, low-carbon purchasing Intention, and the value of doctrine of the mean Scale to conduct an empirical analysis through the fsQCA method to configure the antecedent variables that affect low-carbon purchasing willingness. The findings indicate that: social norms, future orientation, perceived consumer effectiveness, the value of doctrine of the mean have positive impact on low-carbon purchasing willingness. Furthermore, in the absence of social norms, future orientation and the value of doctrine of the mean are sufficient conditions to influence the formation of low-carbon purchasing behavior will.

Keywords

Social norms, Low-carbon purchasing, future orientation, The value of doctrine of the mean, Qualitative fuzzy sets

1. Introduction

With the global warming crisis becoming more severe, reducing greenhouse gas emissions has become a common problem for all countries in the world in order to survive. According to the International Energy Agency's (IEA) report "Global Energy Review: Carbon Dioxide Emissions in 2021," global carbon dioxide emissions reached 36.3 billion tons in 2021, a record high. China led the way, accounting for 33% of total global emissions, followed by the United States (13%), and India (7%). The issue of excessive energy consumption has severely hampered China's economy and society's long-term development. As a result, achieving low-carbon development in the future is a significant challenge for China. Low-carbon development is an organic combination of the words "low carbon

"and "development," and optimizing the energy supply structure and energy consumption pattern is an important step towards achieving low-carbon development (He, Li, Zhang et al., 2002). The adjustment of energy structure is dependent on the breakthrough and innovation of renewable and clean energy technology at the production end, which is currently in its infancy and requires a lengthy research and development cycle. Changing energy consumption patterns is the key to low-carbon social and economic system transformation. Energy consumption refers to the amount of energy used in industrial production and by residents. Residents' consumption is the end point of economic activity, the driving force behind industrial production, and the source of CO2 emissions. As a result, it is critical to strengthen consumer responsibility on the consumption side and force the transformation and upgrading of the energy structure and industrial structure (Zhuang, 2021).

2. Research Theory

Low-carbon purchasing refers to the special consumption behavior of consumers during the purchase, use, and disposal processes that is guided by low-carbon consciousness and aims to reduce greenhouse gas emissions (carbon dioxide, methane, etc.) (Ma & Men, 2022). Its focus is on reducing non-toxic environmental damage such as greenhouse gas emissions. Its carbon reduction effect will take time to manifest. As a result, low-carbon purchasing requires people to have a long-term vision, pay attention to the future thinking mode, and have faith in changing the climate environment.

Social norms are informal rules that govern group behavior (Legros & Cislaghi, 2020), as opposed to mandatory legal systems. People in China's "relationship" culture pay more attention to their social selves (Yan & Yang, 2017), emphasize their relationships with others, are more easily influenced by those around them, and adhere to social norms and rules that most people recognize. Scholars have discovered that consumers may change their consumption behavior due to suggestions from others or "face consciousness," and that social norms are the most important factors influencing consumers' purchasing behavior (Cialdini & Jacobso, 2021). Perceived Consumer Effectiveness refers to the degree to which consumers believe that their actions will have a positive impact on solving a social or environmental problem (Castro-Santa, Drews, & van den Bergh, 2023). In the low-carbon purchasing scenario, the perception of consumer efficiency has a significant impact on consumers' purchase decisions. Specifically, it influences consumers' perceptions, attitudes, and behavioral choices towards low-carbon products, which in turn drives or hinders low-carbon purchases. Future-orientation, how much an individual pays attention to the future and attaches importance to long-term goals, has a significant impact on low-carbon purchasing behavior. Consumers with a strong future orientation are more likely to consider the long-term environmental impact of their consumption behavior and choose low-carbon products (Li, 2022). China's values of moderation, derived from Confucianism, emphasize moderation, balance and harmony, and advocate avoiding extremes in behavior and thinking, and pursuing the path of righteousness. The values of moderation emphasize the harmonious coexistence of man and nature, and advocate respect for nature and protection of the environment. This philosophy

prompts consumers to consider the environmental impact of products in their purchasing decisions, and tend to choose eco-friendly low-carbon products to achieve a balance between man and nature (Du & Duan, 2022).

3. Research Design and Research Methods

3.1 Questionnaire Design

The social norms are revised in the context of low-carbon purchasing, which is divided into two dimensions: descriptive norms and Injunctive norms, with a total of six measurement items, such as "Friends, relatives, and neighbors around me think I should choose low-carbon purchasing behavior". Future orientation draws lessons from the Future Outcome Consideration Scale developed by Feng Jiaxi (Feng,Wang, & Zhang, 2020) and others, and selects five measurement items, such as "I prefer to do things that can bring more long-term benefits than things Perceived consumer effectiveness is based on Roberts' research (Roberts, 1996), this scale is used to measure consumers' perception of effective information about their own behavior and their expected assessment of the impact of their behavior on the environment and it includes four measurement items, such as "What I do can have a meaningful impact on environmental issues," of which two are scored in reverse. Low-carbon purchasing is willing to refer to the scale developed by chan r.y.k. (Chan, 2001) and others, This scale measures consumers' acceptance of low-carbon purchasing behavior from the perspective of low-carbon beliefs and low-carbon lifestyles, with a total of four measurement items, such as "I am willing to pay more attention to low-carbon consumption trends and actively respond to low-carbon consumption."

The measurement of the value of doctrine of the mean was carried out using a scale developed by Wu Jiahui et al. (Wu & Lin, 2005), which has been widely used in Chinese contexts and consists of three measurement items, such as "I usually consider the harmony of the overall atmosphere when deciding opinions.

3.2 Data Collection and Sample Analysis

This study used a questionnaire survey to collect data, collected from 30/08/2024 to 10/09/2024, and 499 questionnaires were distributed through the WeChat platform. The respondents of this study were selected through online verbal inquiries and answering the first question of the questionnaire (“Do you know about low-carbon consumption?” and “Are you willing to participate in this survey?”). Therefore, the first question is also a record of the respondent's voluntary participation in the survey. The criteria for determining the invalidity of the questionnaire are as follows: (1) answering time less than 60 seconds; (2) the same option appearing multiple times in the questionnaire. Additionally， in order to comply with ethical guidelines, the study's respondents do not include minors.

The data analysis results show that Cronbach's α values for all variables are greater than 0.6, indicating that the questionnaire's information reliability is acceptable and the reliability test was passed. The standardized load coefficients of two items in the variable future orientation and one item in the variable low-carbon purchasing intention, however, are low and fail to meet the standard of 0.6,

whereas the standardized load coefficients of all other variable items are greater than 0.6. As a result, these three items are removed. After deletion, the reliability and validity were assessed once more. The reliability and validity of each variable are good, Descriptive Norms (Cronbach's α= 0.765, AVE=0.538, CR=0.776), Injunctive Norms (Cronbach's α= 0.755, AVE=0.512, CR=0.748), Future Orientation (Cronbach's α= 0.767, AVE=0.594, CR=0.814), Perceived Consumer Effectiveness (Cronbach's α= 0.764, AVE=0.541, CR=0.780), Low carbon purchase intention (Cronbach's α= 0.739, AVE=0.532, CR=0.772), the value of doctrine of the mean （ Cronbach's α=0.755 ， AVE=0.548,CR=0.783）.All variables had a Cronbach's coefficient greater than 0.6, the standardized load coefficient was greater than 0.6, the combined reliability (CR) was greater than 0.7, and the average variance extraction was greater than 0.5, indicating that this study had good convergence validity. As a result, the measurement scale formed after adjusting the questionnaire was reliable in terms of reliability and validity.

3.3 Common Method Deviation Test

Because this study adopts the form of self-report, there may be common method deviation among variables. Therefore, the questionnaire survey process is controlled by anonymous survey, partial use of reverse items, and emphasizing that there is no right or wrong way to fill in the questionnaire. Using one-factor confirmatory factor analysis, the common method deviation test was carried out for all self-evaluation items. The results showed that the model fitting was very poor,$\chi 2/df = 7.632 > 3$, RMSEA = 0.132＞0.05, GFI= 0.679＜0.9, AGFI= 0.611＜ 0.9, cfi = 0.673＜0.9.

4. Qualitative Comparative Analysis of Fuzzy Sets

In this study, fsQCA 3.0 software is used to analyze the conditions that form the willing result of low-carbon purchasing. The original values (average scores) of six variables (descriptive norms, injunctive norms, future orientation, perceived consumer effectiveness, the value of doctrine of the mean, and low-carbon purchasing willingness) are transformed into a set of three membership scores (between 0 and 1) to define complete membership, complete non-membership, and intermediate points. Because this study uses a 5-point Likert scale, we chose 4.0 (generally consistent), 3.0 (uncertain), and 2.0 (inconsistent) as the calibration parameters of complete membership, intermediate point, and complete non-membership based on previous research (Yadav, Balaji, & Jebarajakirthy, 2019).

Table 1. Necessity Analysis of Conditions

Variable Name	Consistency	Coverage (%)
DSN	0.819	0.861
~DSN	0.232	0.722
ISN	0.787	0.837

~ISN	0.260	0.701
FO	0.913	0.848
~FO	0.126	0.642
PCE	0.902	0.838
~PCE	0.139	0.708
VDM	0.896	0.862
~VDM	0.154	0.656

Note. The symbol "~ "stands for "does not exist".

Second, the analysis of necessary conditions is tested to see if there are any causal conditions that can be considered necessary for the result's existence or non-existence (behavioral intention). If the consistency score exceeds 0.90 (Gong & Sun, 2021), the condition is considered "necessary." Future orientation (consistency =0.913) and Perceived Consumer Effectiveness (consistency =0.902) are required conditions for a high level of low-carbon purchasing behavior will, as shown in Table 1. This demonstrates that future orientation and perceived consumer effectiveness are required for high-level behavioral intentions.

Finally, we can detect various causal configurations that lead to the level of low-carbon purchasing willingness using sufficient condition analysis. Using the fuzzy set algorithm, a truth table is generated from the calibration value. The original consistency threshold is set to 0.80, the case frequency threshold is set to 3, and the PRI consistency is ≥0.75. Given the results' rationality and moderate complexity, this paper opts for the intermediate solution to explain them. Table 2 depicts the antecedent variable configuration of the final consumer's low-carbon purchasing behavior intention. Where ● indicates that the condition appears, indicating that the condition does not appear, and spaces indicate that the condition variable can exist or not. As shown in Table 6, the overall coverage rate of the results with high low-carbon purchasing willingness is 0.825, and the overall consistency is 0.881, indicating that the model is well explained.

Table 2. Antecedent Variable Configuration of Consumers' low-carbon purchasing Intention

structural shape	S1	S2	S3	S4	S5
DSN	●	●		●	⊗
ISN	●	●			⊗
FO	●	●	●		●
PCE		●	●	●	
VDM	●		●	●	●
consistency	0.912	0.908	0.894	0.889	0.944
Original	0.611	0.600	0.761	0.692	0.111

coverage rate					
Unique coverage	0.045	0.038	0.084	0.039	0.007
Overall consistency	0.881				
Overall coverage rate	0.825				

As shown in Table 2, there are five paths to triggering low-carbon purchasing behavior. Further examination of the intermediate solution reveals that social norm variables are present in both configurations S1 and S2, with configuration S1 representing the emergence of social norm, future orientation, and the value of doctrine of the mean. For social norms, future orientation, and perceived consumer effectiveness, configuration S2 appears. The consistency of the S1 and S2 configurations is greater than 0.9, and the original coverage rate is 0.611 and 0.600, respectively, indicating that the two configurations can explain 61.1% and 60% of the cases, respectively.

Configuration S3 is the appearance of future orientation, perceived consumer efficacy, and the value of doctrine of the mean, with the highest consistency of 0.894 and original coverage of 0.761 among all configurations, indicating that the combination of the three is a sufficient condition to affect the willingness of low-carbon purchasing, and the intermediary role of future orientation and perceived consumer efficacy has been confirmed again. Configuration S4 is the appearance of descriptive norms, perceived efficacy, and the value of doctrine of the mean, with a consistency of 0.889 and original coverage of 0.692, confirming the combined function of descriptive norms and perceived consumer efficacy, as well as the significant influence of descriptive norms on people's behavioral will. Future orientation and the value of doctrine of the mean appear in configuration S5, but social norms do not. The consistency is 0.944, and the original coverage rate is 0.11, accounting for only 11.1% of the cases and belonging to individual cases. This configuration demonstrates that future orientation and the value of doctrine of the mean are sufficient conditions to influence low-carbon purchasing behavior intention in groups who are unaware of social norms.

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