

Research on Low Carbon Consumption Intention Survey and Incentive Mechanism under the Dual Carbon Goal

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ABSTRACT

In order to explore residents' low carbon consumption intention, this paper constructs a model of the influencing factors of low carbon consumption willingness through multiple linear regression with the help of planning behavior theory, and studies the incentive mechanism of carbon credits according to the model results. The results show that low carbon consumption behavior attitude, subjective norm and perceptual behavior control all have a positive impact on low carbon consumption intention, and the three independent variables can explain 77.1% of the changes in the dependent variable, among which perceptual behavior control has the greatest impact. Based on the results of the model, this paper briefly studies the incentive mechanism of carbon credits, and finally puts forward some reasonable suggestions for low carbon consumption based on the actual situation, so as to actively respond to and promote low carbon consumption actions.

KEYWORDS

Low Carbon Consumption Intention; The Theory of Planned Behavior; Multiple Linear Regression; Carbon Credit Incentives

1. INTRODUCTION

1.1. Research Background

As the global climate problem becomes increasingly prominent, how to balance the relationship between economic development and ecological environment has become a hot topic of concern for all sectors of society. Although carbon emissions on the production side need to be controlled, carbon emissions control on the consumer side is also urgent. In recent years, the rapid development of the economy has been accompanied by the consumption mode of high carbon emissions, which not only consumes a lot of energy, but also produces a large amount of carbon dioxide, which is the most important gas component of greenhouse gases, which has also become an important reason for the intensification of the greenhouse effect. In response to the important challenge of climate change, in September 2020, China put forward the goals of "carbon peak by 2030" and "carbon neutrality by 2060". Therefore, it is of great significance to reduce carbon emissions and improve residents' consumption patterns with high carbon emissions for carbon emission reduction actions and the practice of green development concepts.

With the continuous advancement of China's carbon peak and carbon neutrality strategy, the main idea of helping to achieve the "double carbon" goal with a green and low carbon lifestyle has basically taken shape. In order to improve the public's awareness of low carbon consumption and motivate the public to actively participate in low carbon actions, this project focuses on the investigation of low

carbon consumption willingness and the research on incentive mechanism. According to a study released by the Chinese Academy of Sciences, household consumption accounts for 53% of total carbon emissions. It can be seen that the impact of Chinese residents' living and consumption patterns on greenhouse gas emissions cannot be ignored. In September 2020, the China Council for International Cooperation on Environment and Development (CCICED) released a policy research report on "Green Transformation and Sustainable Social Governance", which pointed out that during the 14th Five-Year Plan period, China's green consumption should focus on key areas such as food, housing, transportation, use, clothing, and tourism, promote green, low carbon and economical methods, and accelerate the construction of green consumption patterns to promote ecological environment improvement and high-quality development [1].

1.2. Research Status

As an important component of the carbon emission system, low carbon consumption has become the focus of many scholars' research, and there are abundant studies on low carbon consumption in the academic community. Diyun Peng et al. studied the influencing factors of residents' low carbon consumption behavior in Nanchang through multiple stepwise regression [2]. Yidi Cao et al. explored the impact of low carbon consumption psychology on low carbon consumption behavior through multiple linear regression [3]. Chuanghua Luo used binary logistic regression to study the impact of policy factors on residents' willingness to consume low carbon [4]. Changliu Jiang et al. focused on the government, enterprises, and consumers to construct urban low carbon consumption patterns and conducted research on incentive policies [5]. Shu Wang constructed a "consciousness-situation-behavior" model to explore the impact of consciousness and context on low carbon consumption behavior [6].

At present, most of the relevant literature focuses on unilateral factors, based on specific groups. Therefore, this paper chooses to conduct research on residents' low carbon consumption from the macro level, and makes breakthroughs from the following two points.

First, conduct multi-faceted and multi-angle research. The research on the influencing factors of residents' low carbon consumption willingness and behavior is carried out from many aspects, not only considering a single factor, but also including important influencing factors as much as possible.

Second, focus on the practicality of results. This paper not only studies the willingness of low carbon consumption, but also expands the research perspective to a more practical level according to the actual situation, that is, to explore and implement the specific implementation of the incentive mechanism, to provide some suggestions or help for the construction of a low carbon consumption system, and to provide richer perspectives and methods for solving practical problems.

1.3. Theoretical Basis and Research Hypothesis

The Planned Behavior Theory (TPB)[7] is proposed by Ajzen based on the rational behavior theory, according to which the actual behavior of an individual is not randomly or purposelessly generated, but is affected by the individual's behavioral intention, which is affected by the three aspects of behavioral attitude, subjective norm and perceptual behavior control. Because planned behavior theory considers the interaction of psychological and social factors, TPB has been widely used to predict and explain a wide range of behaviors, and it is also very effective in studying consumer behavior.

Planned behavior theory assumes that individuals will act rationally based on their attitudes, subjective norms, and perceived behavioral controls, these factors are not necessarily actively or consciously considered in people's decision-making processes, but they form the backdrop of the decision-making process [8].Based on the theory of planned behavior, this paper analyzes the

willingness of low carbon consumption from three aspects: behavioral attitude, subjective norm and perceptual behavior control, and makes relevant research hypotheses.

(1) Low carbon consumption behavior intention. Behavioral Intention refers to a person's judgment of the subjective possibility of a certain action on their own, and the degree to which a person accepts a certain action. Residents' willingness to engage in low carbon consumption indicates whether residents are willing to engage in low carbon consumption.

(2) Low carbon consumption behavior attitude. Behavioral Attitude refers to the positive or negative emotions that an individual has about a certain behavior, that is, an attitude formed after the conceptualization of the individual's evaluation of this specific behavior, so the components of the attitude are often regarded as a function of the individual's significant belief about the outcome of the behavior. Residents' behavioral attitudes towards low carbon consumption can be understood as residents' positive or negative feelings or evaluations of low carbon consumption.

Therefore, this paper makes a research hypothesis 1: residents' low carbon consumption behavior attitude is positively correlated with behavioral intention, that is, the more positive the low carbon consumption behavior attitude, the more confident they are in low carbon consumption, and the more willing they will be to low carbon consumption.

(3) Subjective Norm. Subjective Norms refer to the social pressure that individuals feel about whether to take a specific behavior, that is, when predicting the behavior of others, those people or organizations that have an influence on an individual's behavioral decisions have an impact on whether an individual takes a specific behavior. When these groups have a good evaluation of low carbon consumption and engage in low carbon consumption, residents may have herd behavior, which in turn affects residents' willingness to consume low carbon.

Therefore, this paper makes a research hypothesis 2: subjective norms are positively correlated with behavioral intentions, that is, whether external actors are willing to engage in low carbon consumption will also be affected by the same direction.

(4) Perceived Behavioral Control. Perceptual Behavior Control refers to the obstacles encountered by an individual in the past experience, when the individual feels that he has more resources and opportunities, the smaller the obstacles, then the stronger his perceptual control over the behavior.

Therefore, this paper makes a research hypothesis 3: perceptual behavior control is positively correlated with behavioral intention, that is, the stronger the perceptual behavior control, the higher the residents' own conditions, and the stronger their willingness to low carbon consumption.

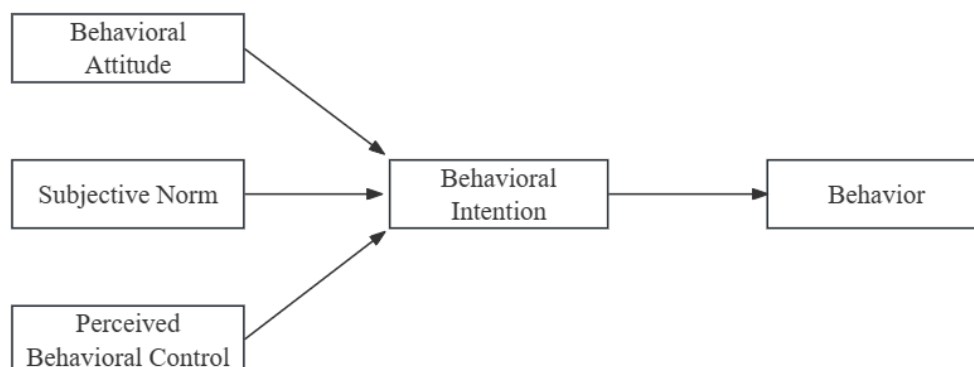


Figure 1. the Theory of Planned Behavior

2. INVESTIGATION AND RESEARCH ON LOW CARBON CONSUMPTION INTENTIONS

2.1. Questionnaire Design

Since low carbon consumption behavior attitudes, subjective norms, perceptual behavior control and behavioral intentions cannot be directly observed, this paper selects the Likert 5-level scale to investigate, reasonably designs the questionnaire topics through the study of existing literature, combined with the actual situation, and forms a high-quality questionnaire through continuous discussion and revision. The questionnaire mainly consists of the following four parts.

The first part is the independent variable BA of residents' behavioral attitude towards low carbon consumption, which is set up with four questions, four questions corresponding to four subvariables, and the variable codes are BA1, BA2, BA3, and BA4, respectively.

The second part is the subjective normative independent variable SN, which has 3 questions under this dimension, and the corresponding variable codes are SN1, SN2, and SN3.

The third part is the independent variable PBC of perceptual behavior control, and three questions are set under this dimension, and the corresponding variable codes are PBC1, PBC2, and PBC3 respectively.

The fourth part is BI, the dependent variable of low carbon consumption intention, which has four questions under this dimension, and the corresponding variable codes are BI1, BI2, BI3, and BI4 respectively.

2.2. Questionnaire Reliability and Validity Test

The reliability test is used to test the stability and reliability of the questionnaire results, and the Cronbach's Alpha coefficient is used to evaluate the higher the coefficient, the better the internal consistency of the questionnaire. The Cronbach's alpha coefficient of each variable was greater than 0.75, and the overall Cronbach's alpha coefficient of the questionnaire was 0.943, indicating that the questionnaire had good internal consistency and stability. Table 1 shows the details.

Table 1. Reliability statistics for each variable

Variable type	Variable name	Investigation items	Cronbach's Alpha
Independent variable	Behavioral Attitude (BA)	BA1-BA4	0.862
	Subjective Norm (SN)	SN1-SN3	0.803
	Perceived Behavioral Control(PBC)	PBC1-PBC3	0.770
Dependent variable	Behavioral Intention (BI)	BI1-BI4	0.808

Validity tests are used to judge the accuracy of questionnaire tests, including content validity tests and construct validity tests. As for the test of the validity of the questionnaire content, the questionnaire was finalized after repeated revisions through research data and pre-survey before the formal survey. As for the test of the validity of the questionnaire structure, the commonly used factor analysis method is used to test the validity, and the test results are shown in Table 2.

Table 2. Variables and overall validity statistics

Variable		BA	SN	PBC	BI	Totality
KMO Test		0.824	0.687	0.697	0.780	0.939
Bartlett's Test of Sphericity	χ^2	208.489	113.009	88.066	148.687	1016.545
	df	6	3	3	6	91
	P	0.000	0.000	0.000	0.000	0.000

As can be seen from Table 2, the KMO test for BA and BI items was more than 0.75, and the KMO test values for SN and PBC were slightly lower than 0.7, which may be related to the fact that they only had 3 question options. The significance level of Bartlett's spherical test for each sub-item was 0.000, according to which the test results could be considered to be good for the construct validity test of the paper questionnaire.

2.3. Regression Analysis

Multiple linear regression is used to study the significance of the effect of independent variables on the combined linearity of dependent variables[9]. The attitude, subjective norm and perceptual behavior control of low carbon consumption behavior were taken as independent variables, and residents' low carbon consumption willingness was used as the dependent variable, and the multiple linear regression equation was constructed, and the significance test table was obtained, as shown in Table 3.

Table 3. Regression analysis results

Variable type	Coefficient B	P	VIF
(Constant)	0.493	0.005	
BA	0.176**	0.016	3.034
SN	0.276***	0.000	3.437
PBC	0.419***	0.000	2.673
R²	0.771		
F	124.231(P=0.000)		
Note: *** indicates significant at the 1% level; ** indicates significant at the 5% level; * indicates significant at the 10% level.			

It can be seen from the Table 3 that the P value corresponding to the F value is 0.000, which is less than 0.05, indicating that various influencing factors have a significant impact on residents' low carbon consumption intention. The decision coefficient is 0.771, so the fitting degree of the multiple linear regression model is 77.1%, which means that the independent variable factors in the model can explain 77.1% of the changes in the dependent variable, and the model has a high degree of interpretation of the data. The P values of the three independent variables were all less than 0.05, which indicated that the three independent variables passed the significance test, and the corresponding variance expansion factor VIF was less than 5, indicating that there was no obvious collinearity between the independent variables. The coefficient B is greater than 0, indicating that the attitude of low carbon consumption behavior, subjective norm and perceptual behavior control have a significant positive impact on the willingness of low carbon consumption, so the three assumptions made in this paper are all valid. The final multiple linear regression equation is as follows:

$$BI = 0.493 + 0.176BA + 0.276SN + 0.419PBC \quad (1)$$

Through the linear regression equation, it can be seen that the coefficient in front of PBC is 0.419, indicating that Perceptual Behavior Control is the decisive antecedent for low carbon consumption intention, followed by SN (Subjective Norm), and then Behavioral Attitude.

3. RESEARCH ON THE INCENTIVE MECHANISM OF CARBON CREDITS BASED ON BLOCKCHAIN

According to the results of the multiple linear regression model, among the three influencing factors of behavioral attitude, subjective norm and perceptual behavior control, perceptual behavior control has the highest impact on individuals' low carbon consumption intention. The control of residents' low carbon consumption perception and behavior involves not only the individual's cognition of his or her own executable ability, but also the perception of external factors that may affect the implementation of low carbon consumption behavior. When a person perceives a low carbon consumption behavior to be easy to implement, they are more likely to perform it; When they find it difficult to implement a low carbon consumption behavior, they are more likely not to do so. Therefore, how to make low carbon consumption behavior more convenient to implement has become one of the keys to whether residents are willing to engage in low carbon consumption.

In order to encourage residents to participate in low carbon consumption, this paper chooses to build a carbon credit incentive mechanism supported by blockchain, open a personal carbon credit account to record personal low carbon consumption, and reward residents accordingly to improve their enthusiasm for participating in low carbon consumption. The blockchain system is decentralized, and each carbon emission data record generates a unique, tamper-proof digital signature through a specific algorithm to ensure the authenticity and credibility of each data record[10]. The blockchain system is introduced into the mechanism, and the system automatically collects, audits, stores and converts the low carbon consumption behaviors generated by users through the carbon credit account, so as to transfer the low carbon consumption behavior to the personal carbon credit account in the form of issuing carbon credits, and the points can be converted into currency for consumption, which will positively affect the perception and behavior control of residents to a certain extent, and then affect the willingness of low carbon consumption.

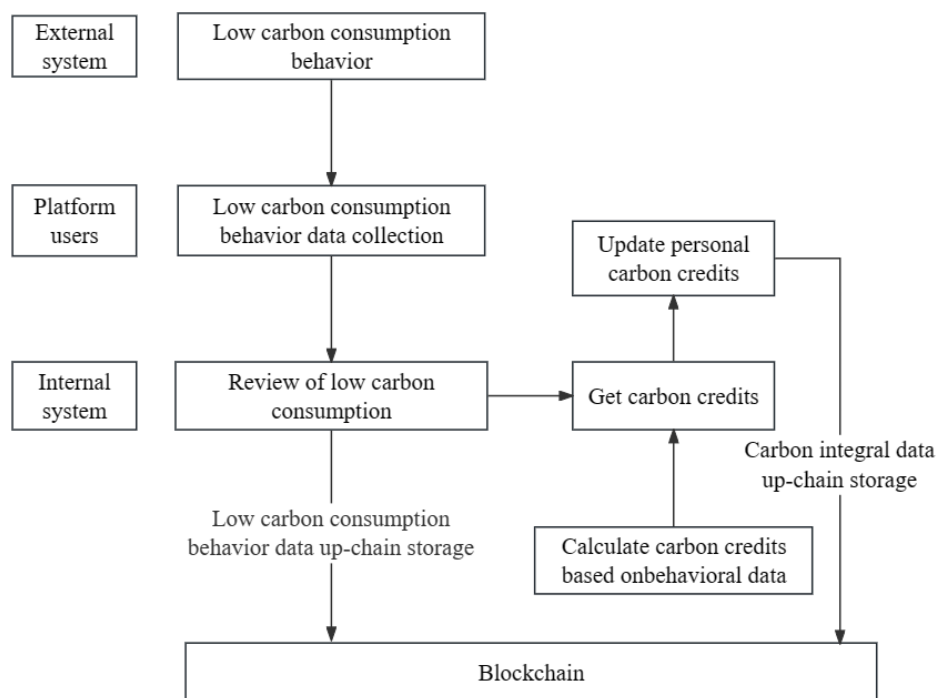


Figure 2. Flow chart of carbon credit incentive mechanism

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions of the Study

In this paper, the multiple linear regression model is used to study the low carbon consumption intention, and the regression model of the influencing factors of the low carbon consumption willingness is obtained, and the three hypotheses are verified.

(1) Low carbon consumption behavior has a positive impact on low carbon consumption intention. The more positive the attitude towards low carbon consumption, the stronger the individual's awareness of low carbon responsibility and the more willing he is to engage in low carbon consumption.

(2) Subjective Norms have a positive impact on low carbon consumption intentions. This indicates that residents' willingness to consume low carbon will be influenced by their family, friends or external media, so in order to promote residents' willingness to consume low carbon, relevant policies can be promoted.

(3) Perceptual Behavior Control has a positive impact on low carbon consumption intention, and the influence effect is higher than that of behavioral attitude and subjective norms. This indicates that the convenience of the implementation of low carbon consumption behavior will affect the low carbon consumption willingness to the greatest extent, so the cost of low carbon consumption behavior can be reduced and the willingness of residents to low carbon consumption can be improved by simplifying the low carbon consumption behavior mode and issuing low carbon consumption behavior incentives.

4.2. Countermeasures and Suggestions

Achieving rapid and high-quality development of low carbon consumption requires the joint efforts of all sectors of society. Based on the research conclusions, this paper puts forward the following relevant suggestions based on the actual development situation, hoping to help improve the low carbon consumption system.

(1) Residents should raise their awareness of low carbon responsibility. As people in the new era, we should establish correct low carbon consumption values, strengthen our own low carbon consumption behavior, and actively guide others to join in the action of low carbon consumption.

(2) Vigorously create a low carbon consumption atmosphere and environment. The environment in which an individual lives affects his or her behavioral attitude, and letting consumers be in a low carbon consumption environment can effectively influence low carbon consumption behavior and attitude, and can play a role in promoting low carbon consumption.

(3) Reduce the cost of low carbon consumption and strengthen the incentive mechanism for low carbon consumption. Compared with the cost of ordinary products, the cost of low carbon products is higher, which is also an important factor hindering low carbon consumption. Relevant enterprises should strengthen technological innovation and reduce production costs; At the same time, the government can give preferential policies to companies that actively produce low carbon products or implement carbon credit incentives to encourage consumers to voluntarily choose low carbon products.

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