

Research on the reasons for the disunity of knowing and doing in low-carbon consumption — based on the grounded theory

Yuhan Zhong , Xiaomei Fu , Tianle Huang and Chen Chen*

Sichuan Agricultural University, 611830, Chengdu, Sichuan, China

Abstract: Under the background of "carbon peaking and carbon neutrality", the carbon emissions produced by the public's daily consumption cannot be ignored. However, the data show that there is a disunity of knowing and doing in low-carbon consumption. How to get out of the dilemma, and how to guide the public to the low-carbon consumption mode has become an urgent issue to be solved. This study uses the research method of in-depth interview and the grounded theory to build a research model suitable for the analysis of low-carbon consumption behavior, and explains the disunity of knowing and doing. The results show that low-carbon knowledge, personal benefits, moral image and social norms have significant effects on low-carbon consumption behavior, and the mechanisms and paths of their effects are different. On this basis, this study explores and integrates the "knowledge-cognition-behavior" model to analyse low-carbon consumption behaviors, which can provide targeted policy ideas and implementation paths for relevant institutions.

1 Questions

With the development of economy and society and the acceleration of industrialization, the problems of environmental pollution, resource depletion and climate change have become more and more prominent. So the international community pays more and more attention to environmental protection. According to the UN Environment Programme's 2020 emissions gap report, households currently consume about two-thirds of global greenhouse gas emissions. In China, household living consumption accounts for 53 percent of society's total carbon emissions. It can be seen that the carbon emission from individual living consumption is grim and cannot be ignored. However, theoretical circles tend to focus on the total carbon emissions and production carbon emissions, and the research on consumption carbon emissions is relatively lagging behind¹. Therefore, how to guide consumers' living consumption mode to low-energy consumption, low-pollution and low-emission is a focus topic to be solved.

Although the public has formed a sense of low-carbon consumption, there are widespread phenomena of "just saying without doing", "high awareness but low practice". According to the China Public Environmental Protection Index report, it clearly reveals that one of the two internal contradictions of public environmental protection in China is the contradiction between environmental awareness and environmental action. In terms of environmental awareness, 87% of the residents believe

that China's environmental pollution degree is serious, and environmental protection is imperative. However, among the more than 20 environmental protection behaviors, the implementation rate of about half of the environmental protection behaviors is less than 30%². Thus, it can be seen that low-carbon consumption is easy to know but difficult to do, and has become a key obstacle to promoting the low-carbon consumption mode.

So the question is that why does the public have such a disunity of knowing and doing on low-carbon consumption? The essence of this problem lies in exploring the internal factors and influencing path of the public in the process from knowledge to action, and uncovering the black box of the public's different knowledge and action. Based on it, this study aims to explore the internal and external factors that influence the public's implementation of low-carbon consumption behavior, and the mechanism of these key factors in the transformation process of knowledge and action.

2 Literature review

In view of the definition of low-carbon knowledge, low-carbon consumption behavior and so on, the academic circle has not objectively formed a completely unified definition. But its general content and connotation characteristics are more consistent. Therefore, this study refers to Liu Yuxiao (2021)³ and defines low-carbon cognition as a reflection of psychological activities, which includes the awareness of the reality of resource

* Corresponding author: Chenchen 595990477@qq.com

and environmental issues and the responsibility for environmental protection. Reference to Wang Jianming (2011)⁴, Low-carbon consumption behavior in this study refers to the public consciously reducing resource and energy consumption and reducing pollutant emissions (especially carbon dioxide emissions) during their daily life consumption.

As for the gap between individual knowledge and behavior, in the previous research, most of the literature directly set that knowledge and behavior are high or even completely consistent, and carried out low-carbon behavior research under this assumption, which ignores the complex transformation process between knowledge and behavior obviously, which is unreasonable and unscientific. In later studies, some literature has found that knowledge and behavior are not completely consistent. For example, Hines (1985)⁵ directly pointed out that knowledge and behavior are not the same, and deviation between them is entirely possible. After further research and analysis, it is found and confirmed that the public do have different knowledge and behaviors in low-carbon consumption. For example, by investigating the British, Whitmarsh (2009)⁶ found that people's usual starting point of energy-saving behavior is to save money for themselves, which has nothing to do with environmental awareness and cognition.

As for the disunity of knowing and doing in low-carbon consumption, scholars have made different discussions and explanations. The representative research directions are mainly as follows. Earlier studies focused on demographic trait variables, noting that women and high-income earners are more likely to buy green products.^{7,8} However, as the research goes deeper, most scholars point out that demographic factors cannot explain public behavior compared with psychological awareness⁹. According to the theory of planned behavior of Ajzen (1991)¹⁰, the greater the external normative pressure, the more likely they are to adopt specific behaviors. Wang Jianming (2015)¹¹ took environmental emotion as the research entry point and put forward the two-factor theory hypothesis of emotion-behavior. The conclusion pointed out that environmental emotion can activate, organize and adjust low-carbon behavior by strengthening psychological investment. However, the effect of environmental emotion is only obvious for high carbon consumption behavior. And the prediction and explanation of general non-low carbon consumption behavior are insufficient.

As can be seen from the above literature research, scholars have made different discussions on the dilemma of low carbon consumption. The analytical methods and theoretical models have been constantly improved, but there are still some things to explore: First, from the research dimension, scholars focus on a single factor to explain low carbon consumption. For example, the hindrance of group pressure, psychological factors and moral image in the transformation of knowledge and behavior are measured separately. In fact, in the actual consumption scenario, the public's low-carbon consumption behavior is the result of the interaction between individuals, environment, material, culture and other factors. Therefore, the current research is not

comprehensive and systematic, and it is easy to miss some key factors to make the research into one-sided. Second, from the perspective of research methods, most scholars' analysis and interpretation is still stuck in the descriptive language interpretation and theoretical construction. Few literature deeply examines the internal mechanism of different knowledge and behavior, which has some limitations and superficial aspects. According to the current severe situation of carbon emission reduction, the government urgently needs scientific and in-depth theoretical basis and empirical research to support its decision, which is also a powerful realistic driving force to promote relevant research depth.

Based on the above literature, this study tries to integrate the internal individual factors and external scenario factors into an overall framework. Using depth interview of qualitative research and the grounded theory, this study explains the disunity of knowing and doing in public's low-carbon consumption systematically and comprehensively, discusses the mediation variables in the process of knowing-doing transformation and its influence path, explores the moderating variable between knowledge and behaviors and their boundary conditions, to help crack the problem.

3 Methods and data sources

3.1 Methods

For low-carbon consumption, there is no mature variable category and measurement scale. In view of this, this study interviewed the representative public through semi-structured questionnaires to obtain first-hand information, using the grounded theory to explore the disunity between low-carbon knowledge and behavior.

3.2 Research design

In view of the qualitative research requires respondents to have a certain understanding of the research problems, combined with the research problems and purpose, this research adopts the theoretical sampling method to select ordinary consumers with rich information.

This study mainly get the data by personal in-depth interviews, which can give respondents sufficient thinking space. And through inspiring discussion and interactive incentives, researchers can better observe and find out respondents' attitudes, experiences and potential factors. After the consent of the respondents, the data were recorded by making audio recordings and taking notes. Each interview lasted for 30-to-40 minutes. The basic information of the respondents is shown in Table 1.

Table 1. List of basic information of the respondents

Number	Gender	Age	Income	Degree
Respondent 01	Female	19	1200RMB	B.S.
Respondent 02	Male	42	6000RMB	B.S.
Respondent 03	Male	20	2000RMB	B.S.
Respondent 04	Female	35	12000RMB	M
Respondent 05	Male	22	1500RMB	B.S.
Respondent 06	Male	20	1600RMB	B.S.
Respondent 07	Male	30	7000RMB	B.S.
Respondent 08	Male	22	8000RMB	B.S.
Respondent 09	Male	48	4500RMB	B.S.
Respondent 10	Female	36	7500RMB	B.S.
Respondent 11	Male	21	1800RMB	B.S.
Respondent 12	Male	25	15000RMB	B.S.
Respondent 13	Male	27	7000RMB	Junior high
Respondent 14	Female	20	1200RMB	B.S.
Respondent 15	Female	22	1600RMB	B.S.

Number of	Gender	Age	Income	Degree
Respondent 16	Female	19	1400RMB	B.S.
Respondent 17	Male	20	1500RMB	B.S.
Respondent 18	Female	28	6000RMB	Junior high
Respondent 19	Male	19	1200RMB	B.S.
Respondent 20	Female	51	4500RMB	Junior high

During the formal interview, Firstly, the researcher explained the purpose, and promised to strictly protect the personal privacy information. And then the researcher asked the respondents about the connotation of low-carbon consumption. After that, the research explained the low-carbon consumption of the research; then entered the subject for in-depth interview. During the interview, the researchers mainly understood the respondents' consumption psychology and behavior about themselves and the people around them, so as to have a more comprehensive understanding of the true inner thoughts of the respondents.

4 Category refining

4.1 Open coding

In order to maximize the objectivity of the original data and minimize the subjective influence of the researchers' personal experience and observation, multiple researchers independently coded the same sample box independently.

According to the principle of open coding, the researchers sorted out the original notes and records word by word, and extracted the sentences which are related to low-carbon consumption. After removing the irrelevant components such as tone words, a total of 216 original sentences nearly 8,000 words were obtained. At the same time, in order to query and retrieve data accurately and quickly, this study conducted open coding according to the order of "respondent number - answer information number", for example, "01-01" represents the first valid answer information of the first respondent.

By summarizing the key information ,this research formed the 14 initial categories containing low-carbon consumption knowledge, environmental protection concept, civic responsibility awareness, knowledge of validity of acts, the needs of individual health, the needs of living consumption, individual economic benefits, behavioral convenience, self-image building, personal value realization, face-saving culture, social media campaigns, government policy and education from home and school , which is shown in Table 2.

Table 2. Initial coding

Category	Representative initial statement (initial concept)
Low-carbon consumption knowledge	<p>01-01 In terms of meals, I don't know which one is green, but I have just heard of green and organic food, but there is no such food sold around me (lack of low-carbon consumption knowledge, weak knowledge and weak behavior)</p> <p>19-07 Do Not know much knowledge about low carbon, do not understand what low carbon is (lack of low carbon consumption knowledge, weak knowledge and weak behavior)</p> <p>08-07 As a consumer, or an ordinary person, we cannot identify and choose (lack of low-carbon consumption knowledge, weak knowledge and weak behavior)</p>
Environmental protection concept	<p>11-05 Without low-carbon consumption, we may not be enough about this concept, for example, the implementation of the " Food conservation " policy, is to eat up or eat as little as possible, we may not have fully formed this concept. (save resources, strong knowledge and strong behavior)</p> <p>10-07 Every time you buy something, order takeout and so on, you will see the non-degradable garbage, which will cause great pollution to the environment (environmental pollution, strong knowledge and strong behavior)</p> <p>10-06 I realize that the environment is getting worse and worse (environmental awareness, strong knowledge and strong behavior)</p>
Sense of civic responsibility	<p>11-06 In the general environment, I may actually know a little bit more about carbon neutrality, but this low-carbon consumption is actually not very deep, because it does not have much impact on our personal things (weak sense of responsibility, strong knowledge and weak behavior)</p> <p>17-07 In fact, taking these behaviors and other behaviors will not have any impact on my doing this thing itself, all taking this behavior is just beneficial to the environment, kill two birds with one stone (strong sense of responsibility, weak knowledge)</p> <p>06-02 I just feel that everyone should do this, which is more of a responsibility and obligation (strong sense of responsibility, strong knowledge and strong behavior).</p>
Self-efficacy perception	<p>16-13 I feel that if I do this once, I do not have much impact on the environment, or at least I have no bad impact on the environment, not any positive effect on it, or at least I have no negative effect (no merit or no fault)</p> <p>14-06 I think generation by generation to form this consciousness, low-carbon awareness will become stronger and stronger, or have a certain role in environmental protection. (Effective in the future)</p> <p>09-10 I think individual efforts are very small, but if I can lead others around me to form a low-carbon concept, I think a little makes a lot. If many people work together to do this, it will definitely have a certain impact on carbon emissions.(Many hands make light work)</p>
Individual health needs	<p>18-03 I feel that the disposable things in the hotel are not very hygienic. I will bring my own daily necessities when I travel (health and hygiene).</p> <p>05-03 Driving less, purely because walking is healthier (your own health)</p> <p>12-02 Drinking milk tea using a paper straw feels harmless, so I use it (harmless to myself)</p>
Living consumption needs	<p>11-11 For example, air conditioning is turned on 26 degrees, not entirely because of low carbon and energy saving but this temperature is more appropriate (life comfort needs)</p> <p>02-03 It is more comfortable to use your own daily necessities when staying in a hotel (for living comfort)</p> <p>12-04 When you buy something, you do not consider whether the packaging is environmentally friendly or not, but only care about whether the things inside are delicious (taste and quality requirements).</p>
Individual economic benefits	<p>20-01 I ride bike to work, because the price is lower (affordable)</p> <p>14-10 I will only turn on one house light in the dormitory alone, which saves money and electricity (price and cost)</p> <p>06-03 Because of the cost of the price, there is an extra expense associated with food packaging (price cost)</p>
Behavioral convenience	<p>11-08 People are beneficial to avoid disadvantages, more inclined to convenient, disposable chopsticks will be more convenient</p> <p>12-17 If I'm in a hurry and it's a long way away, I'll ride my bike.</p> <p>01-05 Short-term travel will not bring too many things, things bring too much trouble</p>
Self-image building	<p>13-11 Do these behaviors will be recognized by others, is happy, be recognized by others will be more active to do these things (sense of identity)</p> <p>16-15 They feel that these behaviors form an environmentally concerned self. (caring)</p> <p>15-06 I'm afraid I'm different from them. (agree)</p>

Personal value realization	11-13 When you do so, you get approval from others, you're happy, you get approval from others and you do these things more actively. (pride) 12-19 After doing green behavior, you will feel very noble (noble sense) 03-03 I take green environmental protection behavior just for my own heart, not caring about other people (moral sense)
Face culture	08-08 When buying mooncakes, they choose excessive package because a key issue involved is that mooncakes are almost not for themselves, and they are all given to others (face culture) 08-10 Environmentally friendly or not, reach the gift-giving goal first (gift giving) 06-03 Taking environmentally friendly behavior is just for my own heart, I do not need to care about others (don't care about others think)
Social media campaigns	11-13 If there is a mobile phone charges, it is full of the publicity that more than 1,000 thermal power stations would be closed nationwide without removing the charging plug in time. This thing shocked me greatly, so I would unplug the plug in time when charging (low carbon and energy saving knowledge popularization) 12-08 As for garbage classification, I learned it from watching news reports (social news publicity) 17-06 Now there are a lot of environmental protection and public service advertising, after watching it people will be more aware of environmental protection (public service advertising publicity)
Government policy	10-08 The country is advocating low-carbon consumption and green life, and following the national development trend (national advocacy) 05-05 Under the guidance of the policy, the Chengdu policy is relatively done in place, such as the Tianfu Greenway, but the rural intensity is insufficient (facility construction) 13-07 Garbage classification national advocacy, conducive to the public environment (national advocacy)
Education from home and school	16-05 I have been exposed to these concepts since I was a child. (family education, school education) 09-12 My family has always had a low-carbon concept and behavior (family behavior) 12-23 Public awareness of low carbon should be cultivated in compulsory education (school education)

4.2 Axial coding

The main task of axial coding is to discover and establish logical connections between initial categories¹². Based on the theme of different knowledge and practice of low-

carbon consumption in this study, different categories are classified according to their mutual relations and logical order at the conceptual level, and four categories are summarized, including "low-carbon knowledge, personal benefits, moral image, and social norms". The main categories and their corresponding open coding categories are shown in Table 3.

Table 3. Main code category

Fundamental category	Corresponding category	Category meaning
Low-carbon knowledge	Low-carbon consumption knowledge	Consumers' perception of low-carbon consumption and low-carbon products.
	Environmental protection concept	Consumers' understanding of the current situation of environment and resources and the influence of consumption behavior on the positive and negative environment.
	Citizens' sense of responsibility	Consumers' awareness of their own responsibility and obligations for environmental protection.
	Self-efficacy perception	Consumers' cognition of the impact of their own consumption behavior on the environment.
Personal benefits	Individual health needs	Consumption meets the needs of individual physical and mental health.
	Living consumption needs	Consumption to meet the needs of the quality of life and function.
	Individual economic benefits	Economic costs, savings, and feedback when spending.
	Behavioral convenience	Time and energy costs saved when consuming.
Moral image	Self image building	Individuals tend to act the same or similar to the image of the person they want to be in order to build an image of themselves.
	Personal value realization	Meet the internal emotional and target needs of consumers.
	Face culture	Show off, highlight their social status, establish their personal image.

Social norm	Social media campaigns	Information in advertising, popular science and other media leads to the trend of consumer behavior towards social norms.
	Government policy	National advocacy and government regulations lead to consumer behavior to social norms.
	Education from home and school	School curriculum, teacher education or family behavior leads to consumer behavior trend towards social norms.

4.3 Selective encoding

Selective coding is to explore the core category and establish the relationship between the core category and other categories through deeper combing on the basis of axial coding. This study has confirmed the core category of "the reasons of the disunity between the low-carbon consumption knowing and doing". Centering on this core category, the "story line" is used to describe the phenomenon and context conditions of consumers' low-carbon consumption behavior. The sorting out of the "story line" is also to explain the reasons for the different knowledge and practice of low-carbon consumption.

Through the above research and analysis, the study is found that the influencing factors of the public low-carbon consumption pattern can be summarized into the following four main categories: low-carbon knowledge, moral image, personal benefits, and social norms. The relationship is shown in Table 4. The following will be elaborated in detail.

Personal benefits can determine low-carbon consumption decisions. On the one hand, from the perspective of low-carbon, low-carbon consumption is an ethical consumption, which is beneficial to the long-term development of society; From the perspective of consumption, the main purpose of consumption is to meet individual needs and is related to individual short-term

interests. When low-carbon consumption fails to meet consumers' expectations, the long-term interests of society conflict with the short-term interests of individuals. On the other hand, according to the theory of customer value, consumers' perceived cost and perceived value will affect consumers' evaluation and thus affect their behavioral decisions¹³. When perceived cost is higher than perceived value, it will result in customer dissatisfaction¹⁴. Therefore, when the long-term interests of society conflict with the short-term interests of individuals, or the public's perceived cost is higher than the perceived benefits, it will lead to the dilemma of low-carbon consumption knowing and doing.

The moral image restrains the individual behavior from the inside of the individual, and makes the individual behavior consistent with the representation of the individual image as far as possible, so as to highlight the individual image. In order to build their own moral image and realize self-protection or self-promotion, the public may also adjust their consumption decisions to implement low-carbon consumption behavior due to their internal moral beliefs^[15].

Social norms put external pressure on an individual's behavior to conform to the expectations of a social group. Social norms can establish, shape and change low-carbon consumption behavior. When others are watching, people will consider others' opinions more. At this time, people will pay more attention to social interests than personal benefits¹⁶, so as to make different consumption decisions.

Table 4. Typical relational structure of the main category

Typical relationship structure	The meaning of relationship structure
knowledge → behavior	Low-carbon knowledge is the main influencing factor of low-carbon consumption behavior; but there is no necessary consistency between knowledge and behavior.
knowledge → personal benefits → behavior	Personal benefits can directly affect the low-carbon consumption behavior, and can feedback the degree of low-carbon knowledge. It is the intermediary factor between the low-carbon knowledge and the low-carbon consumption behavior.
moral image ↓ knowledge→behavior	Moral image can establish, shape and change consumer low-carbon consumption behavior; it affects the direction and intensity of transformation between cognitive-behavior, and is the regulator between low-carbon behavior.
social norms ↓ knowledge→behavior	Social norms can establish, shape and change low-carbon consumption behavior; it affects the direction and intensity of transformation from knowledge to behavior, and is the role of knowing-doing moderating variable.

In summary, this study verifies that there is indeed no necessary consistency between low-carbon knowledge and low-carbon consumption behavior. In addition, on the basis of the "story line", this study constructs the "knowledge-cognition-behavior" model, which is based

on certain low-carbon knowledge. Consumers comprehensively weigh and consider moral image and social norms, form their own actual value perception, and then produce low-carbon consumption behavior. This is shown in Figure 1.

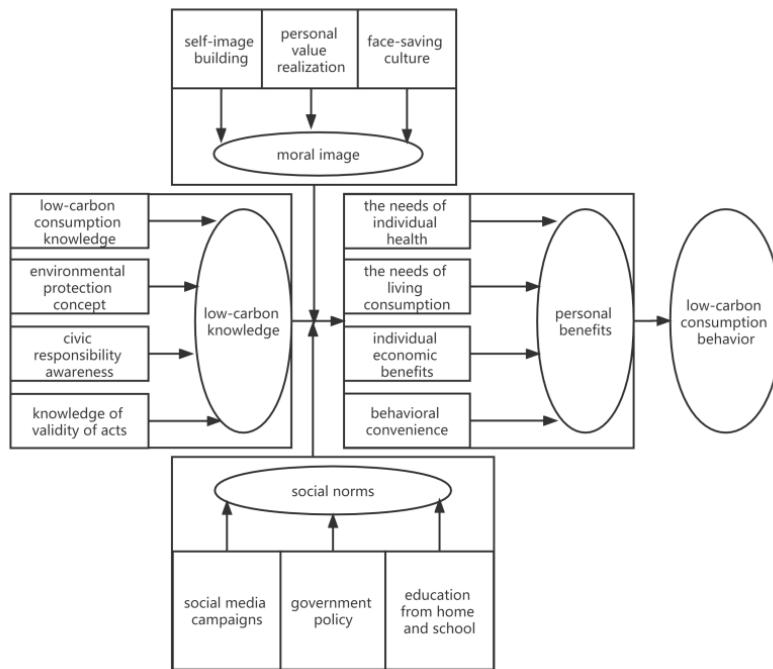


Fig.1. The knowledge-cognition-behavior model

5 Results and discussion

This study uses the grounded theory to explore the reasons why consumers' knowledge and behavior of low-carbon consumption are different. After repeatedly considering and analysis, four main categories are formed, containing low-carbon knowledge, personal benefits, moral image and social norms. Among them, personal benefits are the most important factors of consumers' knowledge and behavior of low-carbon consumption. Moral image and social norms have not yet formed a large-scale social atmosphere. This also explains why there is a conflict between consumers' knowledge and behavior of low-carbon consumption.

Therefore, the practical significance of this study is as follows: First, this study promotes consumers' low-carbon consumption actions through the publicity of the importance of low-carbon consumption behavior to environmental protection; Second, study results will help enterprises to formulate low-carbon consumption strategies at the micro level. The research results have certain reference significance for the product design of enterprises.

The theoretical significance of this study is as follows: Firstly, the study fills in the researches on carbon emission reduction at the micro level. Most of the previous studies on carbon emission reduction are focused on the researches on corporate carbon emission reduction and policy incentives. This study emphasizes that carbon emission reduction responsibility at the micro level is necessary and effective. Second, study results explains why consumers have high awareness but low behavior on low-carbon consumption.

This study also has some limitations. This paper adopts qualitative analysis, and its openness determines

that the research is not combined with quantitative analysis. In subsequent studies, the inductive factors formed in this study can be converted into actual measurement indicators, so as to improve the rationality of the study.

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