Article

Elements of Food Service Design for Low-Carbon Tourism - Based on Tourist Behavior and Attitudes in China

Yingjie Lai [1], Chaemoon Yoo [1], Xiaomin Zhou[1] and Younghwan Pan[1, *]

[1] Department of Smart Experience Design, Kookmin University, Seoul 02707, Korea. lai1129yingjie@163.com

* Correspondence: peterpan@kookmin.ac.kr

Abstract: One of the key issues in sustainable tourism research is the gap between tourists' expressed friendly attitudes towards sustainable behaviors and their actual behaviors. Although many "low-carbon" themed restaurants have emerged during the low-carbon transformation of the Chinese tourism industry, low-carbon food services have not been significantly improved. This study takes food as the entry point to explore tourists' behavior and attitudes towards low-carbon tourism in relation to food. We conducted two interviews. The first interview was a semi-structured contextual interview with 120 tourists who had experiences in food streets, aiming to identify the core user group: low-carbon attitude-friendly tourists with high-carbon food behaviors. The second interviews was an in-depth interview based on grounded theory with 29 core users, analyzing the four main reasons for their high-carbon food behaviors and their requirements for low-carbon food services in tourism. Based on this, we extracted four design elements for low-carbon tourism food services: low-carbon information show service, low-carbon service product attractiveness improvement, low-carbon food environment atmosphere creation, and service providers' low-carbon behaviors. Through these four service elements, we constructed a low-carbon tourism food service design framework based on the core users' needs, discussed the mechanism of service elements, and provided service design suggestions accordingly. The research results serve tourism providers, low-carbon tourism researchers, and designers.

Keywords: low-carbon-tourism food; low-carbon-attitude-friendly tourists; user attitude–action gap; grounded theory; service design

1. Introduction

Warming is a serious environmental and developmental concern facing humanity today, and carbon emissions from tourism make a significant contribution to warming, according to studies [1]. China's carbon emissions and environmental pollution are very serious. In 2009, the State Council of China released Document 41, which defined tourism as a pillar industry of the national economy and highlighted the necessity for tourism to prioritize energy saving and emission reduction [2]. As China's tourism industry continues its low-carbon transition, numerous eco-friendly restaurants have sprung up and gasoline-powered vehicles are being replaced with electric vehicles. More emphasis is placed on low-carbon-tourism facilities, scenic area construction, and energy consumption at tourist destinations by the tourism industry [3]. Food systems are a major contributor to carbon emissions and that food consumption is considered an important experience in the tourism process. After Brown and Belisle examined the influence of food on tourism, food gradually became the focal point of tourism study [4–7]. More tourists visit cities than natural environments as tourist destinations [8]. In China's popular tourist cities, numerous low-carbon restaurants have opened, and local governments have enacted numerous laws to assist the development of low-carbon-tourism food [9]. In the past, China's tourism food development in the low-carbon transition concentrated mostly on low-carbon energy consumption in tourism restaurants, low-carbon procurement, and restaurant

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

transportation [10]. Few tourist restaurants are concerned with low-carbon food service, particularly the attitudes of tourists about the transition of tourist food service to be low-carbon. Today, not only do specialists concentrate on low-carbon technology research in tourism, but they are also beginning to consider the impact of low-carbon-tourism consumption, particularly the low-carbon intentions of tourists, on low-carbon tourism [11]. Some studies on the environmental attitudes of tourists indicate that those with higher environmentally conscious attitudes are more inclined to prioritize environmentally responsible conduct [12–16]. However, studies have shown that pro-environmental attitudes do not always translate into pro-environmental behavior among tourists, and some pro-environmentalists engage in less environmentally responsible behavior while traveling [17,18]. So the real behaviors of low-carbon tourists and the reasons for the change in their behaviors and needs for low-carbon-tourism services need to be studied in depth.

Figure 1 shows, from a service design professional's perspective, the six tasks between the tourist and the service provider. They are accommodation, transportation, sightseeing, shopping, entertainment, and food [19]. Numerous scholars have undertaken in-depth studies on tourism transport and low-carbon destination planning, Teng-Yuan Hsiao finds differences in what experts and tourists consider important in a low-carbon-tourism system, with tourists focusing more on food arrangements for low-carbon-tourism design [20]. More emphasis is placed on the user in service design. The design of low-carbon tourism must take into account the perspectives of tourists. Developing more comprehensive low-carbon-tourism indicators requires a focus on design elements from the standpoint of travelers [21]. Therefore, we focus on food in six tasks, and in this study tourism food refers to tourists' food-related behaviors during tourism[22], and through the analysis of tourists' low-carbon attitude mining and real food action, we determined the reasons for low-carbon attitude-friendly tourists to produce high-carbon food action in real tourism behavior, and their requirements for low-carbon tourism food service in order to extract low-carbon tourism food service design elements.

Figure 1. Tourist-Experience Interaction Model.

The tourism experience process is divided into pre-tourism, during tourism, and post-tourism [23]. Service implies the interaction between the provider and the served recipient, and food service is the interaction between the food service provider and the consumer [24, 25]. This study focuses on consumers' dine-in experience behavior during tourism. Figure 2 demonstrates the research focus of this study.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

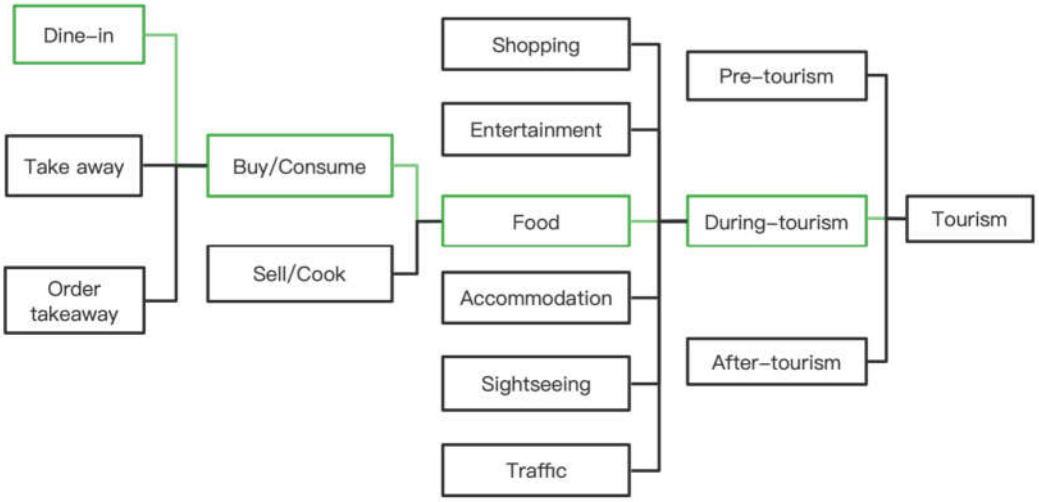

Figure 2. Research Focus.

We conducted semi-structured situational interviews based on grounded theory, and the research questions were: What are the causes of high-carbon food actions in core users? What are the core users' requirements for low-carbon services for tourism food? Construction of a design framework for low-carbon tourism food services.

Based on the above research questions we finally obtained the core users' high-carbon food motivation and their requirements for low-carbon tourism food **service**. And **based on** this, we construct a low-carbon tourism food service design framework based on the core users' needs. Our contribution is to provide food low carbon service design suggestions and theoretical support for Chinese tourism cities and famous food tourism destinations, especially areas dominated by large food districts. Ultimately, the research results may help to promote the development of low carbon services in China's tourism industry**.**

2. Literature Review

2.1. Low-Carbon Tourism Food Service

Low-carbon tourism is a response in action to the notions of sustainable tourism and ecotourism; it is a mode of operation [26]. Low-carbon tourism is an approach to tourism development that is directed by sustainable tourism and focuses on low-carbon technologies and consumption [27, 28]. Low-carbon consumption also includes the tourist food consumption, food consumed by tourists during tourism is referred to as “tourism food” [29]. Sustainable consumption of food is also mentioned in the sustainable food reports on sustainable food as an important component of sustainable food [30]. In a book published in 2020, China's Green Consumption Initiative describes green consumption practices such as energy-saving acts, resource conservation, waste separation, not wasting food, local food, and decreasing solid waste [31, 32]. In food service, it is divided into hard and soft systems, with physical products and products collectively referred to as hard systems and human activities collectively referred to as soft systems [23]. Tourists will experience the food service through six tasks: Search, order, wait, eating, pay, and after meal [33, 34]. Several academics believe that local cuisine can contribute to sustainable tourism while molding the destination's image [35-37]. Some scholars have also conducted low-carbon studies on the production process of food products, suggesting low-carbon proposals in sourcing, preparation and presentation [38]. The low-carbon nature of food itself has also been studied by many scholars, who found that meat has a larger carbon emission than other foods [39,40]. Carbon emissions can be reduced through changes to food services that influence the behavior of tourists and providers.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

2.2. Low-Carbon-Attitude-Friendly Tourists

There is no definitive definition or evaluation criteria for low-carbon -attitude-friendly tourists. Low-carbon tourism is a means of achieving tourism sustainability; therefore, our study of low-carbon- attitude-friendly tourists refers to the research literature on pro-environment tourists. Tourists' low-carbon attitudes refer to tourists' attitudes towards low-carbon tourism when conducting tourism activities [41]. Many scholars have found that when visitors are more concerned about the environment, they are more likely to be less likely to produce behaviors that harm the environment [42, 43]. Carbon behavior of tourists refers to the behavior of tourists in relation to carbon emissions while performing tourism activities [44]. pro-environmental behavior includes a willingness to pay more for green hotels, to save water and energy, to reduce waste, and to recycle during tourism [45]. Tourists who dispose of solid waste properly and spend more on local products are pro-environment tourists who are more concerned about carbon offset vouchers, product eco-labeling, tourism charity and environmental issues [46, 47]. Studies of tourists have focused more on their attitudes toward low-carbon, and fewer researchers have conducted studies of actual tourist behavior. However, some studies have also found a gap between the environmental attitudes expressed by tourists and their real travel behavior. After they express friendly attitudes, but they hardly renounce the pleasure of less sustainable choices [48, 49].

In summary, the majority of studies on low-carbon tourism food have concentrated on the low-carbon nature of the food production process and the food itself. Most tourist studies are centered on quantitative analyses of visitors' propensity to travel in low-carbon tourism and the establishment of pro-environmental tourist scales, but few researchers have evaluated travelers' actual behavior after researching their attitudes. So it is very important to study the low carbon service of tourist food through the attitude and behavior gap of tourists.

3. Research Methods

We first conducted a desk research, which can help this study to better understand the current status of the low-carbon transition in China's tourism industry. Secondly, user research and analysis were conducted based on grounded theory using the interview method, Figure 3 shows the research process of this study.

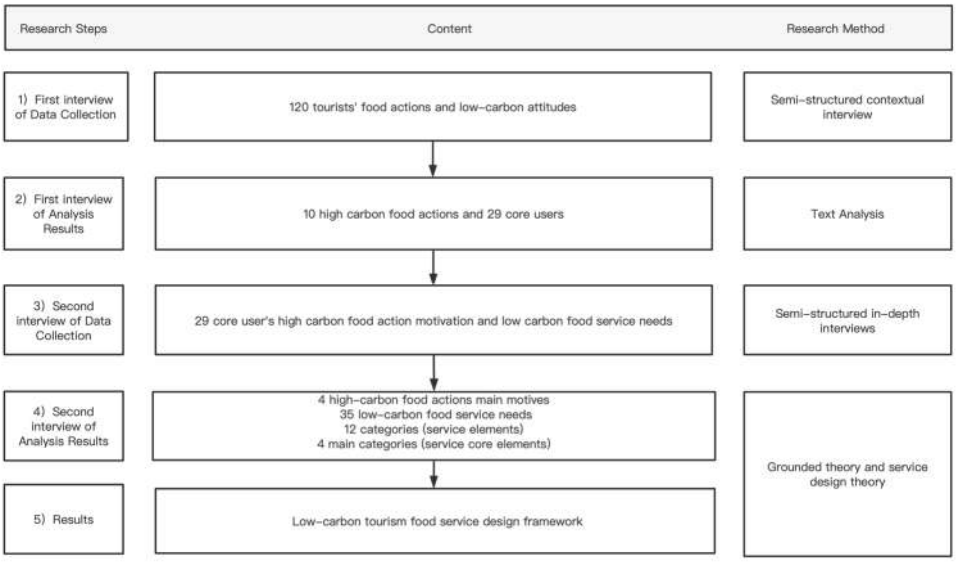

Figure 3. Research process.

 doi:10.20944/preprints202304.0232.v1

3.2. Grounded Theory

Grounded theory is a set of analytical methods that are organized and generalized from primary sources, With the development of grounded theory, three schools of thought have been formed, namely, "classical grounded theory," "procedural grounded theory," and "constructivist grounded theory [50]. This study analyzed the user interview data based on the coding method of procedural grounded theory. The main reasons for using this research method are as follows:

This study is without a direct hypothesis, and its variables and experimental model are unclear as food service involves a complex service system with various stakeholders [51].

1) On the other hand, this study was unable to predict the behavior and requirements of food-service providers and visitors in advance. Therefore, it is necessary to use the exploratory Grounded Theory and conduct in-depth interviews to uncover the underlying elements and relationships [52].

2) Procedural grounded theory often uses purposive sampling, which is consistent with the purpose of our study [53].

3) The coding method of procedural grounded theory can make our element extraction process clearer [54].

3.3. Interview Method

In qualitative research, the interview method is one of the most widely used and most researched methods by researchers to uncover the real behavioral and psychological characteristics of research subjects [55, 56]. The reasons for using the interview method in this study were:

1) It is difficult to obtain more realistic responses in the form of questionnaires, both in terms of finding tourists' high-carbon food actions and tourists' attitudes toward low-carbon tourism.

2) Interviews can leave relatively sufficient room for participants to think and express themselves, and the researcher can also carefully observe the external expressions and internal psychology of the interviewees, so as to understand as deeply as possible the attitudes and emotions of the interviewees towards this dine-in low-carbon service.

3) The exploration of participants' food actions and attitudes requires the researcher to guide the participants to recall a complete dine-in experience, and the researcher can help the participants recall more details through continuous and repeated questioning.

Therefore, to gain a comprehensive understanding of the tourist dine-in experience and to discover the real food behavior of low-carbon-attitude-friendly tourists, we used only the interview method for the user study.

Two semi-structured contextual interviews were conducted for this study, to unpack the research purpose-based conversation around the tourists' food experiences and guide tourists to articulate how they were acting at the time and their moods and attitudes in a particular context [57]. The second in-depth core user interview was conducted to discover the reasons for the high-carbon food actions and their requirements for low-carbon-tourism food services.

The recruitment of participants needs to take into account differences in food available in different regions of China and differences in the food consumption of tourists [58]. In the first random food street interviews, four cities in South, North, Central, and Eastern China were chosen (GuangZhou, BeiJin, ChengDu, XiaMen). These four cities are known for their morning tea, northern food, hot pot, and seafood respectively [59-62]. We selected interview moderators in each city in close proximity to well-known tourist destinations. On the same holiday, four moderators randomly selected tourists on the street until each obtained 30 valid interview texts [63] (see Appendix A for specific participant information). After analyzing the interview data, we obtained 29 core users. The participants in the second in-depth interview were 29 core users, a group of tourists who were somewhat conscious of low-carbon environmental protection and friendly towards low-

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

carbon-tourism food practices. Their high-carbon food actions are much easier to change [11, 64]. Each participant consents to the use and disclosure of their information. Table 1 shows a summary of the two interviews.

Table 1. Summary of the two interviews.

Title 1	First interview	Second interview
Period	10.1, 2022	10.10–19, 2022
Participants	People who have experienced food street tours in four famous tourist cities	29 core users
Methods	Semi-structured situational interviews	In-depth interview
Purpose	Core users	High-carbon food actions motivation and need for low-carbon-tourism food services
Interview framework	Participant Information Collection Participant food behavior [30, 33, 34] Participant low-carbon attitude [41, 45-47]	Reasons for participants' high-carbon actions Participant needs for low-carbon tourism food services

4. Research Process and Results

4.1. Analysis and Results of the First Interview Data Collection

4.1.1. First Interview of Data Collection

A total of 120 valid text data were collected in the first interviews. The purpose of the interviews was to discover the high-carbon food actions of the participants, as well as to find the core users. Each interview lasts for 5–10 minutes. Table 2 shows the participants information.

Table 2. First interview participants information

Item		Frequency (person)	Percentage (%)
AI		120	100
Gender	Male	49	41%
	Female	71	59%
Age	<=20	16	13 %
	21–30	78	65%
	31–40	20	17%
	>40	6	5%
Education	High school	1	0.83%
	Three-year college Education	11	9.17%
	Bachelor's degree	93	77.5%
	Master	12	10%
	Doctor	3	2.5%

Before beginning an interview, moderators should have a clear understanding of the primary interview objectives, but they should not have any predetermined preconceptions [65]. For smooth data collection, we designed the interview guide before the interview as shown in Table 3. The first part of the interview guide was constructed to collect information from the participants, The second part to guide them—in a way that did not indicate the purpose of the study—to recall the actions that arose during the food experience [30, 33, 34]. The third part explores participants' attitudes toward low-carbon

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

information, products, services, and rules of restaurants during their tourism food experiences [41, 45-47]. The framework for the interviews was formed based on the main purpose of the first round of research, while the detailed interview questions were based on realistic interview situations and the sensitivity of the moderators.

Table 3. First round of interview guide

Purpose	Framework
1. Participants information	Basic Information.
2. Participants action	Guiding participants to recall a recent complete dine-in meal, and find what do participants do in the following steps? Search, order, wait, eating, pay, and after meal
3. Participants attitude	Tapping into participants attitudes towards this food experience: 1) Attitudes towards low-carbon products, services, or rules. 2) Attitudes towards the cost of low-carbon products or services. 3) Attention span to low-carbon-tips information.

4.1.2. First interview of Analysis Results

Food-related tourism carbon emissions are associated with food waste, garbage accumulation, and resource and energy waste caused by tourists [66, 67]. From the interview data, we obtained 33 food actions. After excluding non-carbon-related actions that do not result in high-carbon emissions, a total of 10 high-carbon food actions remained. Table 4 shows the summary of the participants' high-carbon food actions.

Table 4. Summary of participants' high-carbon food actions

	Action
1.	Littering everywhere
2.	Discarding takeout food
3.	Continuous or repeated heating of food
4.	Took menus from many different restaurants and discarded them
5.	Asking for Additional Disposable Dining Room Sets
6.	Using lots of paper towels to wipe down the table or tableware
7.	Leftovers are not taken out to eat elsewhere
8.	Accidentally ordering food that contains ingredients they can't eat
9.	Ordering too much food
10.	Ordered a set meal but did not finish it

We searched for 36 tourists who have a friendly attitude towards low carbon by analyzing the interview data from the participants' attitude part. Table 5 shows an example of friendly tourist screening.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

Table 5. Example of participant attitude refinement

Participant No.	Original Sentence	Secondary Refining	Attitude
B5	"I have used a carbon credit applet for scenic spots, yes, I think it's fun, and you will get points for buying low-carbon drinks. "	Think low-carbon services are interesting.	Friendly attitude towards low-carbon products, services or rules during the tour.
	"I will take the initiative to pay attention to the sign of saving paper, directly，the four large characters are directly printed on the paper box and are very conspicuous. "	Proactive attention to low-carbon information.	Have a concern for low-carbon-tips information during the tour.

Out of the 36 tourists who have a friendly attitude towards low carbon, 29 had high-carbon food actions. In terms of participants' real food actions and attitudes towards low-carbon tourism, we divided the participants in this interview into four categories as shown in Figure 4.

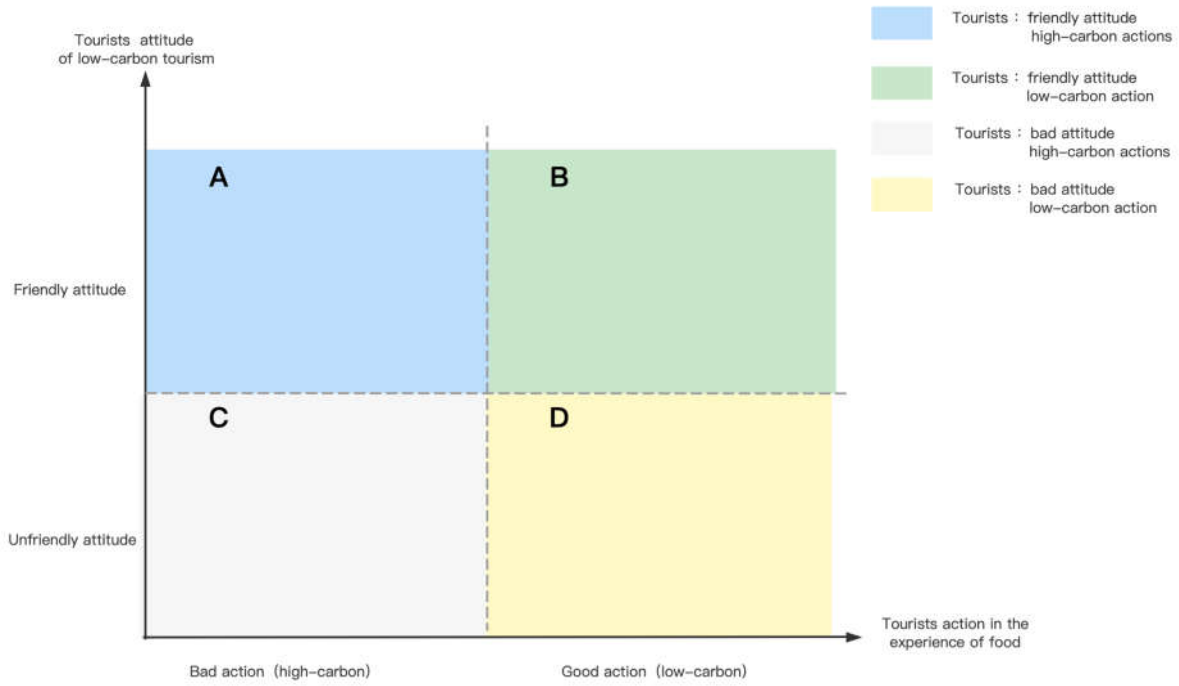

Figure 4. Classification of participants.

Tourists in Category A are friendly to low-carbon tourism but have some high-carbon actions when it comes to real food experiences; they are concerned about low-carbon service in restaurants and have some low-carbon awareness, only that high-carbon actions arise for various reasons. Category B is for tourists who have a friendly attitude towards low-carbon tourism and do not act in a high-carbon way during their food experience, who have a good awareness of low-carbon and are aware of the environmental impact of their actions and show it in their real actions. Category C is for tourists who are not concerned about low-carbon tourism, feel that low carbon is not very important in tourism, and have real high-carbon actions. Category D is for tourists who are not concerned about

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

low-carbon tourism and feel that low carbon is not very important in tourism, although they did not have any high-carbon food actions this time. Users of category B are well in control of their actions without much help. Users in categories C and D, because of their poor attitudes towards low-carbon tourism, find it difficult to make design interventions. Category A tourists have a friendly attitude towards low-carbon tourism and are more likely to intervene in action by design, so our core user group is the category A users. Their needs for low-carbon-tourism food services are more worthy of our attention.

4.2. Analysis and Results of the Second-Interview Data Collection

4.2.1. Second interview of Data Collection

A total of 29 valid text data from in-depth interviews were collected in the second interview. Participants are 29 core users. Table 6 shows the participants information.

Table 6. Second interview participants information

Item		Frequency (person)	Percentage (%)
AI		29	100
Gender	Male	14	48%
	Female	15	52%
Age	<=20	3	10%
	21–30	17	59%
	31–40	7	24%
	>40	2	7%
Education	High school	0	0%
	Three-year college Education	2	6.9%
	Bachelor's degree	23	79.31%
	Master	1	3.45%
	Doctor	3	10.34%

Each interview lasts for 30-40 minutes. The purpose of this interview was to discover the reasons for the high-carbon food actions of core users and their requirements for low-carbon-tourism food services. Based on the results of the first interview, the interview guide explores core users in two ways: first, to explore the causes of their high-carbon food action, and second, to explore their requirements for low-carbon food services. Interview-specific questions were asked based on the results of the first core users interview. Table 7 shows the second interview guide.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

Table 7. Second round of interview guide

Purpose	Framework
1. Reasons for high-carbon food behavior of core users	Multi-angle consulting Continuous consulting
2. Requirements for low-carbon tourism food service of core users	what would enable you to reduce this type of action? what do you think the service provider can do to improve? what are your requirements for improvement methods?

4.2.2. Second interview of Analysis Results

Due to the large number of Chinese transcripts involved in the interview sample and coding process, only the results of the analysis are presented in this study.

The original core users interview data was processed based on Grounded Theory to uncover the reasons for core users high-carbon food actions and suggestions for low-carbon food services. A total of 145 sentences were extracted from the section on the causes of high-carbon food actions, and the inductive classification yielded a total of 34 initial causes and 12 sub-causes after secondary induction. A further grouping of the 12 sub-causes revealed that the reasons why core users would have high-carbon food actions fall into four main categories: (A) the participant is limited by real conditions (75.86%), (B) the participant is influenced by others (65.52%), (C) the participants' actions are influenced by food attitudes (62.07%), and (D) the participant has a lack of low-carbon knowledge(48.28%).

Open coding is a conceptualization of the source material that has been repeatedly categorized and generalized. A total of 153 raw sentences were extracted from the original text about low-carbon food services. A total of 35 low-carbon food-service needs were obtained by analyzing user touchpoints and psychology from the perspective of user research. Table 8 shows the process of extracting the service design needs.

Table 8. The extraction process for the open coding

Participant No.	Original Sentence	Touch Point	psychological	Needs No.	Core User Needs
B5	"It is not necessary to use paper towels, this cloth is hot to the touch, I will feel disinfected and clean"	Warm to the touch	Hot = sanitized = clean	N1	The restaurant provides tools that can be identified as sterilized
G13	"When he gives it to me, he can take it out of the disinfection in front of me and give it to me and I will feel cleaner."	Saw the waiter take it out of the disinfection cabinet	Disinfection cabinet = sterilized = clean		

Axial coding is a further conceptual refinement based on open coding, specifies the attributes and dimensions of the categories [68]. We classified semantically similar concepts among the 35 service needs extracted and distilled them into 12 categories. Table 9 shows the classification results.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

Table 9. 12 Categories

Categories	Service Needs
Low-carbon Food information show service	Food low-carbon information should be fully displayed Low-carbon foods should be distinguished from other foods when displayed
User low-carbon action rules show service	The display of guidance information should be complete Low-carbon slogans should have memorable elements The guidance information display for garbage sorting should be easy to see
Low-carbon knowledge propaganda show service	Display the harmful content that is relevant to users' daily lives. Display position in line with visual habits The design expression should be able to stimulate users' visual or auditory senses.
Low-carbon label show service	The design style of labels should be consistent. Label design that can be considered as low carbon Visually appealing labels
Intelligence enhancement	Users can get feedback Be easily comparable Timely updates Self-service matching
Easy-to-see enhancement	Low-carbon evidence that can be seen interesting introduction Transparent production process
Humanized enhancement	Exclusive offers for low carbon products Low Carbon Theme Activities Recommendations based on user preferences Disposal of leftover food
Tools with low-carbon evidence	Use clean rags Can determine the disinfected tools Tools with low carbon logos
Service staff image	Wear a clean uniform Uniforms with low-carbon guidance
Restaurant image	Authoritative evidence that can be seen Have a uniform style of decoration A clean environment
Service quality of the service provider	Cleaning service carefully Avoid direct contact with dining tools Fully understand low-carbon food
Service provider reminder	Find and stop users' high-carbon actions Provide low-carbon remediation advice

Selective coding is the exploration of the intrinsic connection between axial codes [69].

Find the main categories and inductively refine them to obtain the core categories that can connect all categories [70]. We studied low-carbon tourism food services and identified four low-carbon tourism food service design elements according to the logical relationship between different service categories: Low-Carbon Information Show Service, Low-Carbon Service Product Attractiveness Enhancement, Low-Carbon Food Environment Atmosphere Creation, Low-Carbon-Behavior of Service Provider. We annotated the extracted categories, and Table 10 shows the main and relevant category concepts.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

Table 10. Composition of the main category

Main Category	Main Category Connotation	Corresponding Category	Corresponding Category Connotation
Low-Carbon Information Show Service	The Show service of low carbon information means that low carbon tourism food service needs to show low carbon related information	Low-carbon Food information show service	The low carbon tourism food service needs to have a complete low carbon food information display service that is different from other foods.
		User low-carbon action rules show service	The low carbon tourism food service needs to provide users with complete, easy to read, easy to remember instructions on low carbon rules for user food actions.
		Low-carbon knowledge propaganda show service	The low carbon tourism food service needs to show users low carbon related knowledge.
		Low-carbon label show service	The low carbon tourism food service needs to have a uniform style of product display with low carbon labels.
Low-Carbon Service Product Attractiveness Enhancement	Low carbon service product attractiveness enhancement means that the enhancement of low carbon tourism food service needs to focus on the core attractiveness of the service product	Intelligence enhancement	The enhancement of low carbon tourism food service needs to focus on the intelligence of low carbon service in restaurant service products.
		Easy-to-see enhancement	The enhancement of low carbon tourism food service needs to focus on the ease of seeing low carbon services in restaurant service offerings.
		Humanization enhancement	The improvement of low carbon tourism food service needs to focus on the humanization of low carbon service in restaurant service products.
Low-Carbon Food Environment Atmosphere Creation	Low carbon service environment atmosphere creation means that the enhancement of low carbon tourism food service needs to create a low carbon atmosphere of food experience environment.	Tools with low-carbon evidence	The enhancement of low carbon tourism food service needs to show users evidence of the low carbon of the service tools.
		Service staff image	The enhancement of low carbon tourism food service needs to create a low carbon image of the service staff.
		Restaurant image	The enhancement of low carbon tourism food service needs to create a low carbon image of the restaurant.
Low-Carbon Behavior of Service Provider	Low carbon behavior of service providers means that low carbon tourism food services need service providers who can maintain their own low carbon behavior	Service quality of the service provider	Low carbon tourism food service needs to have service providers who can guarantee the quality of their services.
		Service provider reminder	Low carbon tourism food service needs service providers who can provide low carbon reminders to users.

5. Discussion

With the above coding results, the corresponding main and core categories were extracted in this study. The core category enables the extracted service design elements to be strung together into a coherent whole. Our core category is Food Low-Carbon Service, food low carbon service means the low carbon service that tourists experience when they do food related activities. The structure of the "storyline" is the Low-Carbon Information Show Service and Low-Carbon-Behavior of Service Provider are the realistic conditions for the design of low-carbon tourism food services, the implementation of low-carbon tourism food service design requires service scenarios with low-carbon information display and service providers with low-carbon literacy, Low-Carbon Service Product Attractiveness Enhancement and Low-Carbon Food Environment Atmosphere Creation are the

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

realization path of Low-Carbon Tourism Food Service Design realization, enhancing the attractiveness of Low-Carbon service products and creating a Low-Carbon service environment can improve the quality of low-carbon tourism food service. Based on the "storyline", the framework of Low-Carbon Tourism Food Service Design was constructed. Figure 5 show the framework of Low-Carbon Tourism Food Service Design.

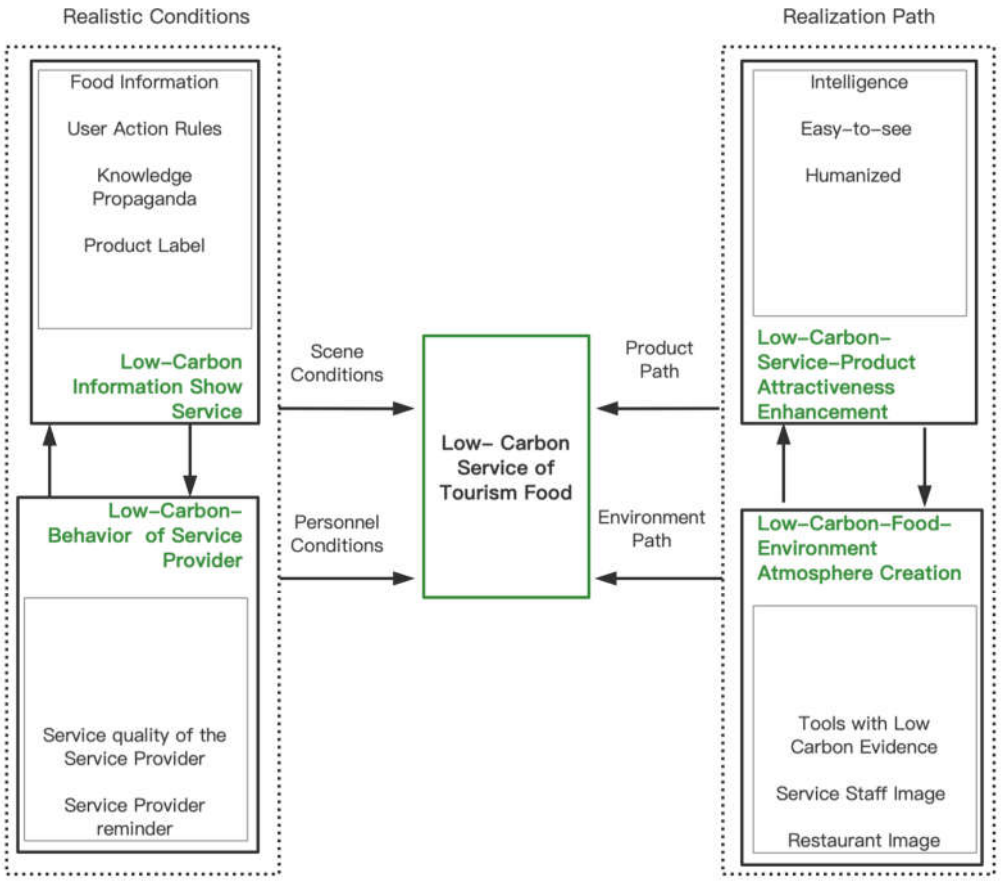

Figure 5. Low Carbon Tourism Food Service Framework.

5.1. Realistic conditions: service scenarios and service personnel guarantee the realization of low-carbon tourism food service design

Low-Carbon Information Show Service and Low-Carbon Behavior of Service Provider is the foundation of low-carbon tourism food services design, which is a realistic condition to have. Low-Carbon Information Show Service and Low-Carbon-Behavior of Service Provider constitute the foundation for the realization of low-carbon tourism food services design, and are the essential conditions that must be met. The presence of Low-Carbon Information Show Service and Low-Carbon-Behavior of Service Provider directly impacts the establishment of low-carbon tourism food services. There is an interplay between Low-Carbon Information Show Service and Low-Carbon Behavior of Service Provider. A complete low carbon information show service can help service providers to provide more specific low carbon services to core user. Low carbon behavior of service providers can help core user to better understand the low carbon information displayed.

5.1.1. Low-Carbon Information Show Service

Low-Carbon Information Show Service is the scene condition for implementing low-carbon tourism food service design. The low-carbon tourism food service design system cannot be separated from the scene with low-carbon information display, which can better convey the information of low-carbon food, rules, and knowledge in the restaurant to

 doi:10.20944/preprints202304.0232.v1

users through service design, so that users can understand the complete information of low-carbon products and the low-carbon services provided by the restaurant. Through interviews, we found that users expect low-carbon information displays to be more intuitive and distinct from other types of information displays. The guiding information should include all necessary information to help users make informed decisions.

5.1.2. Low-Carbon Behavior of Service Provider

Low carbon literate service providers are the personnel condition to achieve low carbon tourism food service design. Low-carbon tourism food service needs to be provided by low-carbon literate service providers to provide professional, timely and proactive services to users. Professional low-carbon services by service providers can give users confidence, timely services can help users better avoid high-carbon food actions, and proactive services can help users understand the restaurant's low-carbon products and low-carbon rules. Through the interviews, we found that the core users prefer the service staff to improve the low-carbon service standard, especially the two aspects of service quality assurance and low-carbon reminder to the users.

5.2. Realization Path: Service Products and Service Environment to Enhance the Effect of Low-Carbon Tourism Food Services

The Low-Carbon Service Product Attractiveness Enhancement and Low-Carbon Food Environment Atmosphere Creation are ways to enhance the effect of low-carbon tourism food services, and they are the realization path to promote the development of low-carbon tourism food services. There is also interplay between Low-Carbon-Service-Product-Attractiveness Enhancement and Low-Carbon-Service-Environment Atmosphere Creation. Enhancing the quality of service products through intelligence, ease of see and humanized can reduce the burden on the service environment and create a more low carbon service environment for core user. Low-Carbon-Service-Environment Atmosphere Creation positively influences the low-carbon service product by creating a low-carbon image of the service tool, the service staff and the service restaurant, and increases core user trust in the service product.

5.2.1. Low-Carbon Service Product Attractiveness Enhancement

Low-Carbon-Service-Product-Attractiveness Enhancement is the product path to promote the development of low-carbon tourism food services. In order to enhance the low-carbon experience of core users, the intelligence, ease of seeing and humanization of service products should be enhanced. Service products must be able to give users positive feedback. The feedback method can be rewards or voice prompts. As core user do not receive feedback, it is difficult for them to maintain low-carbon behavior; thus, designing a multi-sensory response service approach to give core user timely low-carbon feedback on their food behavior can increase their confidence and willingness to be low-carbon [71, 72]. The core users in the interviews mentioned that they wanted low carbon food services to be more interesting and reliable.

5.2.2. Low-Carbon Food Environment Atmosphere Creation

Creating a low-carbon service environment is an effective way to promote the development of low-carbon tourism food services. By providing have low-carbon evidence service tools and enhancing the low-carbon image of service personnel and restaurants, a low-carbon food environment can be created, which can subtly influence core users' high-carbon food actions. Through interview, we found that core user easily combine “clean” with “low-carbon,” and clean products or a clean environment allows them to subconsciously maintain low-carbon actions with more ease. Therefore, the most important thing to focus on when creating a low-carbon atmosphere in restaurants is the clean visual image.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

Based on the above analysis, under the background of low-carbon transformation in the tourism industry, future low-carbon tourism food service design should consider low-carbon information display design, Low-carbon ordering system design, low-carbon food environment design, and low-carbon service training for employees. We have provided design suggestions for these four design directions according to the analysis results. Table 11 shows the design suggestions for low-carbon tourism food services.

Table 11. Design suggestions for low-carbon tourism food services

Design Direction	Suggestions
1. low-carbon information show design	A separate area for show low-carbon food.
	The information on low-carbon food should be displayed in full, especially the price, ingredients, and proof of low-carbon credentials.
	The posters or media promotional materials for low-carbon knowledge should focus on content that is relevant to users' daily lives.
	Design expressions should use impactful colors.
	The appearance of low-carbon labels should be uniform, using trees or other elements related to low-carbon design.
	Display logos on utensils and tools in restaurants.
	The information display for guiding processes in areas such as trash and self-service stations should emphasize the beginning and the end.
	The slogan for guiding processes should be fluent.
	Simple information feedback should be provided for steps that may confuse users.
2. Low-carbon ordering system design	Complete information classification with color differentiation of food.
	UX writing needs to be short and interesting.
	Icon design to increase the user's link to low carbon.
	The introduction of food can be presented in an anthropomorphic manner.
	The low-carbon steps of the production process can be shown in a moving image.
	Low-carbon food offers can be marked on the menu and on receipts.
	Products can be conspicuously labeled as low carbon.
	Low-carbon food on smart devices with a separate link module.
	New low-carbon food information up to date.
	Shopping cart that displays specific information about different foods.
	The low-carbon food in the set can be freely replaced.
	Daily push based on user's browsing and frequently visited restaurants.
3. low-carbon food environment design	Exhibit packaging and utensils' environmental friendliness
	Use energy-saving equipment
	Decorate with natural elements such as wood and bamboo as much as possible
	Minimize the use of plastic utensils
	Similar decorative items to other low carbon themed restaurants
	Display authoritative low-carbon certifications in a prominent position
	Uniform color and style for fresh-looking employee uniforms
	Employee uniforms with low-carbon logo printed on them
	Clean and spacious restaurant environment with simple table setting
4. low-carbon service training for employees	Proactively introduce low carbon food features and offers to users when ordering
	Encourage users after they choose low-carbon food.
	Describe the procedure and outcomes of waste disposal.
	Provide tableware with temperature.
	Secondary cleaning of the table in front of the user.
	Proactive introduction to low-carbon food purchased by users.
	Serve users using trays or wearing gloves.
	Proactively alert users to high-carbon actions and offer more low-carbon alternatives.
	Inform users that they can independently use the low-carbon services.

 doi:10.20944/preprints202304.0232.v1

6. Conclusions

The majority of the direct outcomes of high-carbon behavior in tourism dining-in experiences are related to food waste and restaurant-material waste, according to the findings of this study. The production of methane during the disposal of food waste has made food waste a significant global problem in recent years. Methane is a high-emitting greenhouse gas, and methane emission reduction is also a way to achieve low-carbon tourism [73, 74].

Our research focuses on the dine-in experience of tourists during their travels and introduce the concept of low-carbon-tourism food. Our study identifies the core users by analyzing the food behavior and attitude towards low-carbon among tourists. Through analyzing the underlying reasons for the high-carbon behavior of core users and exploring their needs for low-carbon tourism food services, we aim to extract key design elements for low-carbon tourism food services.

The reasons for high-carbon food behavior among core users can be categorized into four main categories: (A) limited by real conditions, (B) influenced by others, (C) influenced by food attitudes, and (D) lack of low-carbon knowledge. Based on these reasons, we identified 35 core user needs for low-carbon tourism food services, which were further categorized into 12 subcategories and four main categories: (1) Low-Carbon Information Show Service, (2) Low-Carbon Service Product Attractiveness Enhancement, (3) Low-Carbon Food Environment Atmosphere Creation, and (4) Low-Carbon Behavior of Service Providers. We identified the core category of Low-Carbon Food Service and developed a systematic framework for Low-Carbon Tourism Food Service Design based on the needs of core users. Realistic conditions for building low-carbon tourism food services include Low-Carbon Information Show Service and Low-Carbon Behavior of Service Providers, while Low-Carbon Food Environment Atmosphere Creation and Low-Carbon Behavior of Service Providers can help promote the development of low-carbon tourism food services.

It is also crucial to recognize that our study has some limitations; the element extraction data comes solely from tourists, the study area is limited to four cities in China, and the applicability to other types of tourists and other nations and locations is not addressed in this paper. In order to obtain real feedback from the core user, the data was collected using an interview method and the analysis of primary data using only qualitative analysis, which also has limitations.

In the future, based on this study, the research objects of the study can be extended to low-carbon-tourism-friendly-tourists-with-high-carbon-behaviors in tourism transportation, sightseeing, entertainment, shopping, and accommodation to observe whether their real tourism behaviors are low-carbon. The scope of the study will also take into account pre-tour and after-tour studies in order to provide a complete observation of the tourism behaviors of the research object. The research methodology will use a combination of qualitative and quantitative methods for the next steps in the design and experiments. The aim will be to reduce the high-carbon behaviors of low-carbon-tourism-friendly tourists in terms of tourism transportation, tourism sightseeing, tourism entertainment, tourism shopping, and tourism accommodation, and to better achieve the goal of low-carbon tourism.

Author Contributions: Conceptualization, Y.L. and Y.P.; methodology, Y.L.; software, Y.L. and C.L.; validation, Y.P. and Y.L.; formal analysis, Y.L.; investigation, Y.L.; resources, Y.L.; data curation, Y.L.; writing—original draft preparation, Y.L. and C.L.; visualization, Y.L. and X.Z.; supervision, Y.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: All data generated or analyzed during this study are included in this article. The raw data are available from the corresponding author upon reasonable

Conflicts of Interest: The authors declare no conflict of interest.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 April 2023 doi:10.20944/preprints202304.0232.v1

Appendix A

Guang Zhou	Age	Gender	Source	Education	Work
vg1	35	male	local tourists	Three-year college education	Self-employed
vg2	43	female	local tourists	Three-year college education	Government staff
vg3	29	male	local tourists	Master	Corporate staff
vg4	27	female	local tourists	Bachelor's degree	Government staff
vg5	31	male	local tourists	Bachelor's degree	Corporate staff
vg6	30	male	local tourists	Bachelor's degree	Corporate staff
vg7	26	female	local tourists	Bachelor's degree	Corporate staff
vg8	42	female	local tourists	Bachelor's degree	Self-employed
vg9	25	female	non-local tourists	Bachelor's degree	Corporate staff
vg10	27	male	non-local tourists	Bachelor's degree	Corporate staff
vg11	22	female	non-local tourists	Bachelor's degree	Student
vg12	23	female	non-local tourists	Bachelor's degree	Student
vg13	25	male	non-local tourists	Bachelor's degree	Student
vg14	26	female	non-local tourists	Master	Student
vg15	24	male	non-local tourists	Bachelor's degree	Student
vg16	30	female	non-local tourists	Bachelor's degree	Corporate staff
vg17	27	female	non-local tourists	Three-year college education	Government staff
vg18	31	male	non-local tourists	Bachelor's degree	Corporate staff
vg19	22	female	non-local tourists	Bachelor's degree	Student
vg20	23	female	non-local tourists	Bachelor's degree	Student
vg21	27	female	non-local tourists	Bachelor's degree	Corporate staff
vg22	29	female	non-local tourists	Master	Teacher
vg23	35	male	non-local tourists	Bachelor's degree	Self-employed
vg24	38	female	non-local tourists	Bachelor's degree	Corporate staff
vg25	45	male	non-local tourists	Three-year college education	Self-employed
vg26	46	female	non-local tourists	Three-year college education	Government staff
vg27	20	female	non-local tourists	Bachelor's degree	Student
vg28	21	male	non-local tourists	Bachelor's degree	Student
vg29	22	male	non-local tourists	Bachelor's degree	Student
vg30	21	female	non-local tourists	Bachelor's degree	Student
Beijing	**Age**	**Gender**	**Source**	**Education**	**Work**
vb1	32	male	local tourists	Bachelor's degree	Government staff
vb2	25	female	local tourists	Master	Student
vb3	27	female	local tourists	Master	Corporate staff
vb4	22	female	local tourists	Bachelor's degree	Student
vb5	36	male	local tourists	Bachelor's degree	Self-employed
vb6	37	female	non-local tourists	Bachelor's degree	Corporate staff
vb7	34	female	non-local tourists	Bachelor's degree	Corporate staff
vb8	32	female	non-local tourists	Bachelor's degree	Corporate staff
vb9	29	female	non-local tourists	Bachelor's degree	Corporate staff
vb10	41	male	non-local tourists	Bachelor's degree	Government staff
vb11	26	male	non-local tourists	Bachelor's degree	Corporate staff

 doi:10.20944/preprints202304.0232.v1

vb12	26	female	non-local tourists	Bachelor's degree	Corporate staff
vb13	29	female	non-local tourists	Doctor	Student
vb14	32	male	non-local tourists	Bachelor's degree	Self-employed
vb15	30	female	non-local tourists	Bachelor's degree	Self-employed
vb16	34	female	non-local tourists	Bachelor's degree	Corporate staff
vb17	29	female	non-local tourists	Three-year college education	Self-employed
vb18	30	male	non-local tourists	Doctor	Student
vb19	32	male	non-local tourists	Bachelor's degree	Corporate staff
vb20	31	female	non-local tourists	Bachelor's degree	Corporate staff
vb21	37	male	non-local tourists	Bachelor's degree	Self-employed
vb22	37	female	non-local tourists	Bachelor's degree	Government staff
vb23	34	female	non-local tourists	Bachelor's degree	Corporate staff
vb24	26	male	non-local tourists	Master	Corporate staff
vb25	24	female	non-local tourists	Bachelor's degree	Corporate staff
vb26	27	female	non-local tourists	Master	Corporate staff
vb27	23	female	non-local tourists	Bachelor's degree	Student
vb28	22	male	non-local tourists	Bachelor's degree	Student
vb29	20	female	non-local tourists	Bachelor's degree	Student
vb30	25	male	non-local tourists	Master	Student
Cheng Du	**Age**	**Gender**	**Source**	**Education**	**Work**
vc1	23	female	local tourists	Bachelor's degree	Student
vc2	22	female	local tourists	Bachelor's degree	Student
vc3	24	male	local tourists	Bachelor's degree	Student
vc4	21	male	local tourists	Three-year college education	Student
vc5	27	female	local tourists	Master	Student
vc6	31	male	local tourists	Bachelor's degree	Corporate staff
vc7	25	female	local tourists	Bachelor's degree	Government staff
vc8	28	female	local tourists	Bachelor's degree	Self-employed
vc9	19	female	local tourists	Bachelor's degree	Student
vc10	18	male	local tourists	Bachelor's degree	Student
vc11	24	female	local tourists	Bachelor's degree	Student
vc12	27	female	local tourists	Bachelor's degree	Corporate staff
vc13	28	female	non-local tourists	Bachelor's degree	Government staff
vc14	32	female	non-local tourists	Doctor	Teacher
vc15	33	male	non-local tourists	Bachelor's degree	Corporate staff
vc16	23	female	non-local tourists	Bachelor's degree	Student
vc17	22	male	non-local tourists	Bachelor's degree	Student
vc18	23	female	non-local tourists	Bachelor's degree	Student
vc19	23	male	non-local tourists	Bachelor's degree	Student
vc20	24	female	non-local tourists	Bachelor's degree	Student
vc21	22	male	non-local tourists	Bachelor's degree	Student
vc22	20	female	non-local tourists	Bachelor's degree	Student
vc23	21	male	non-local tourists	Bachelor's degree	Student
vc24	20	female	non-local tourists	Bachelor's degree	Student
vc25	20	male	non-local tourists	Three-year college education	Student

 doi:10.20944/preprints202304.0232.v1

vc26	21	female	non-local tourists	Bachelor's degree	Student
vc27	23	male	non-local tourists	Bachelor's degree	Student
vc28	24	male	non-local tourists	Three-year college education	Corporate staff
vc29	24	female	non-local tourists	Bachelor's degree	Student
vc30	28	female	non-local tourists	Master	Government staff
Xia Men	**Age**	**Gender**	**Source**	**Education**	**Work**
vx1	24	female	local tourists	Bachelor's degree	Corporate staff
vx2	46	male	local tourists	Three-year college education	Government staff
vx3	26	female	local tourists	Master	Student
vx4	27	male	local tourists	Bachelor's degree	Student
vx5	22	female	non-local tourists	Bachelor's degree	Student
vx6	23	female	non-local tourists	Bachelor's degree	Student
vx7	19	male	non-local tourists	Bachelor's degree	Student
vx8	19	female	non-local tourists	Three-year college education	Student
vx9	18	male	non-local tourists	high school	Student
vx10	24	female	non-local tourists	Bachelor's degree	Student
vx11	26	male	non-local tourists	Bachelor's degree	Corporate staff
vx12	23	female	non-local tourists	Bachelor's degree	Student
vx13	24	female	non-local tourists	Bachelor's degree	Student
vx14	26	male	non-local tourists	Bachelor's degree	Self-employed
vx15	23	female	non-local tourists	Bachelor's degree	Student
vx16	22	female	non-local tourists	Bachelor's degree	Student
vx17	20	male	non-local tourists	Bachelor's degree	Student
vx18	21	male	non-local tourists	Bachelor's degree	Student
vx19	20	female	non-local tourists	Bachelor's degree	Student
vx20	21	male	non-local tourists	Bachelor's degree	Student
vx21	23	female	non-local tourists	Bachelor's degree	Student
vx22	23	female	non-local tourists	Bachelor's degree	Student
vx23	19	male	non-local tourists	Bachelor's degree	Student
vx24	20	male	non-local tourists	Bachelor's degree	Student
vx25	21	female	non-local tourists	Bachelor's degree	Student
vx26	20	male	non-local tourists	Bachelor's degree	Student
vx27	19	female	non-local tourists	Bachelor's degree	Student
vx28	24	male	non-local tourists	Bachelor's degree	Student
vx29	24	female	non-local tourists	Bachelor's degree	Student
vx30	26	male	non-local tourists	Master	Student

References

1. Lenzen, M. ; Sun, Y .Y. ; Faturay, F. et al. The carbon footprint of global tourism. *Nature climate change* **2018,** *8(6)*: 522-528.
2. Liu, Z.; Guan, D.;Crawford-Brown, D. et al. A low-carbon road map for China. *Nature* **2013**, *500(7461):* 143-145.
3. Luo J, Zhang M. Route Choice of low-carbon industry for global climatechange: an issue of China tourism reform. *Energy Procedia, **2011**, 5: 2283-2288.*
4. Tukker, A.; Huppes, G.; Guinée, J. B. et al. Environmental Impact of Products (EIPRO) Analysis of the life cycle environmental impacts related to the final consumption of the EU-25 **2006**: 1-136.

5. Brown, H. The impact of the tourist industries on the agricultural sectors: the competition for resources and the market for food provided by tourism. **1974.**

6. Lee Jolliffe, Tasting tourism: travelling for food and drink: Priscilla Boniface. *Tourism Management*, ***2005,*** *Volume 26,* 627-628.

7. Bélisle, F. J. Tourism and food production in the Caribbean. *Ann. Tour. Res.* ***1983,*** *10,* 497–513 .

8. Ashworth, G.; Page, S. Urban tourism research: Recent progress and current paradoxes. *Tourism management*, ***2011***, *32(1):* 1-15.

9. Tan X, Guo W, Fan J, et al. Policy framework and technology innovation policy of carbon peak and carbon neutrality. *Bulletin of Chinese Academy of Sciences (Chinese Version)*, ***2022***, 37(4): 435-443.

10. Amicarelli V, Aluculesei A C, Lagioia G, et al. How to manage and minimize food waste in the hotel industry: An exploratory research. *International Journal of Culture, Tourism and Hospitality Research*, ***2022***, 16(1): 152-167.

11. Liu C, Yan . The development of an evaluation model for low carbon tourism consumption behaviour and its empirical application. *Consumer Economy* **2018**. 34.01:36-43.

12. Arvola A, Vassallo M, Dean M, et al. Predicting intentions to purchase organic food: The role of affective and moral attitudes in the Theory of Planned Behaviour. *Appetite*, ***2008***, 50(2-3): 443-454.

13. Han H, Hsu L T J, Sheu C. Application of the theory of planned behavior to green hotel choice: Testing the effect of environmental friendly activities. *Tourism management*, ***2010***, 31(3): 325-334.

14. Han H, Moon H, Hyun S S. Uncovering the determinants of pro-environmental consumption for green hotels and green restaurants: A mixed-method approach. *International Journal of Contemporary Hospitality Management*, ***2020***, 32(4): 1581-1603.

15. Su F, Song N, Shang H, et al. Effects of social capital, risk perception and awareness on environmental protection behavior. *Ecosystem Health and Sustainability*, ***2021***, 7(1): 1942996.

16. Ramayah T, Lee J W C, Lim S. Sustaining the environment through recycling: An empirical study. *Journal of environmental management*, ***2012***, 102: 141-147.

17. Miller D, Merrilees B, Coghlan A. Sustainable urban tourism: Understanding and developing visitor pro-environmental behaviours. *Journal of Sustainable Tourism*, ***2015***, *23*(1): 26-46.

18. Bergin-Seers S, Mair J. Emerging green tourists in Australia: Their behaviours and attitudes. *Tourism and Hospitality Research*, ***2009***, 9(2): 109-119.

19. Linen, W, Shengkui, C. An Empirical Study on Tourism Consumption in Lhasa Based on the Analysis of "Six Elements" of Tourism. *Consumer Economy*,***2013***,29(06):27-30+50.

20. Hsiao T Y. Developing a dual-perspective low-carbon tourism evaluation index system for travel agencies. *Journal of Sustainable Tourism*, ***2016***, 24(12): 1604-1623.

21. Cheng Q, Su B, Tan J. Developing an evaluation index system for low-carbon tourist attractions in China–A case study examining the Xixi wetland. *Tourism Management*, ***2013***, 36: 314-320.

22. Au N, Law R. Categorical classification of tourism dining. *Annals of Tourism Research*, ***2002***, 29(3): 819-833.

23. Tuomi A, Tussyadiah I P. Building the sociomateriality of food service. *International Journal of Hospitality Management*, ***2020***, 89: 102553.

24. Hudson S, Hudson L. Customer service in tourism and hospitality. *Goodfellow Publishers Ltd*, ***2012***.

25. Lillicrap D, Cousins J. Food and beverage service. *Hodder education*, ***2010***.

26. Cai,M. Theoretical and Practical Aspects of Low Carbon Tourism. PhD thesis. *East China Normal University*， *Shanghai, China* **2012.**

27. Walker K, Moscardo G. Encouraging sustainability beyond the tourist experience: ecotourism, interpretation and values. *Journal of Sustainable Tourism*, ***2014***, 22(8): 1175-1196.

28. Ruhanen L, Weiler B, Moyle B D, et al. Trends and patterns in sustainable tourism research: A 25-year bibliometric analysis. *Journal of Sustainable Tourism*, ***2015***, 23(4): 517-535.

29. Au N, Law R. Categorical classification of tourism dining. *Annals of Tourism Research*, ***2002***, 29(3): 819-833.

30. Maguire C, Belchior C, Hoogeveen Y, et al. Food in a green light–a systems approach to sustainable food. *European Environment Agency*, **2017**.

31. Campbell A M, MacRae R. Local Food Plus: the connective tissue in local/sustainable supply chain development. *Local Environment*, ***2013***, 18(5): 557-566.

32. Wan,S. Research on the construction of green consumption model in China in the new era. Ecological Economy.(**2021**).

33. Sun J, Zhu H. A Review of Tourism Food Waste Research and Prospects. *Human Geography*. 1003-2398.(**2021**).

34. Mobley C, Vagias W M, De Ward S L. Exploring additional determinants of environmentally responsible behavior: The influence of environmental literature and environmental attitudes. *Environment and behavior*, ***2010***, 42(4): 420-447.

35. Cohen E, Avieli N. Food in tourism: Attraction and impediment. *Annals of tourism Research*, ***2004,*** 31(4): 755-778.

36. Du Rand G E, Heath E. Towards a framework for food tourism as an element of destination marketing. *Current issues in tourism*, ***2006***, 9(3): 206-234.

37. Sims R. Food, place and authenticity: local food and the sustainable tourism experience. *Journal of sustainable tourism*, ***2009,*** 17(3): 321-336.

38. Stefan Gössling, Brian Garrod, Carlo Aall, John Hille, Paul Peeters, Food management in tourism: Reducing tourism's carbon 'foodprint', *Tourism Management*, Volume 32, Issue 3, ***2011,***Pages 534-543,ISSN 0261-5177.

39. Poore J, Nemecek T. Reducing food's environmental impacts through producers and consumers. *Science*, ***2018,*** *360(6392): 987-992.*

40. Xu X, Sharma P, Shu S, et al. Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods. *Nature Food*, ***2021***, *2(9): 724-732.*
41. Dolnicar S, Crouch G I, Long P. Environment-friendly tourists: what do we really know about them?. *Journal of Sustainable Tourism*, ***2008***, 16(2): 197-210.
42. Ahmed N, Li C, Khan A, et al. Purchase intention toward organic food among young consumers using theory of planned behavior: role of environmental concerns and environmental awareness. *Journal of Environmental Planning and Management*, ***2021***, *64(5): 796-822.*
43. Sanchez-Sabate R, Sabaté J. Consumer attitudes towards environmental concerns of meat consumption: A systematic review. *International journal of environmental research and public health*, ***2019***, *16(7): 1220.*
44. Zhang J. Evaluating regional low-carbon tourism strategies using the fuzzy Delphi-analytic network process approach. *Journal of Cleaner Production*, ***2017***, *141: 409-419.*
45. Han H, Hsu L T J, Lee J S, et al. Are lodging customers ready to go green? An examination of attitudes, demographics, and eco-friendly intentions. *International journal of hospitality management*, ***2011***, 30(2): 345-355.
46. Fairweather J R, Maslin C, Simmons D G. Environmental values and response to ecolabels among international visitors to New Zealand. *Journal of sustainable tourism*, ***2005***, 13(1): 82-98.
47. Dolnicar S, Matus K. Are green tourists a managerially useful target segment?. *Journal of Hospitality & Leisure Marketing*, ***2008***, 17(3-4): 314-334.
48. Taufique K M R, Islam S. Green marketing in emerging Asia: antecedents of green consumer behavior among younger millennials[J]. *Journal of Asia Business Studies*, *2021.*
49. Haase L. Reducing the Attitude-Behavior Gap in the Context of Sustainable Tourism. *2020.*
50. Glaser B G, Strauss A L. The discovery of grounded theory: strategies for qualitative research Aldine Publishing Company. *New York*, ***1967***.
51. Tuomi A, Tussyadiah I P. Building the sociomateriality of food service. *International Journal of Hospitality Management*, ***2020***, 89: 102553.
52. Li F, Pan Y. Research on influencing factors of service interactive experience of digital gas station—The case from China. *Journal of Theoretical and Applied Electronic Commerce Research*, ***2021***, 16(6): 2151-2169.
53. Coyne I T. Sampling in qualitative research. Purposeful and theoretical sampling; merging or clear boundaries?. *Journal of advanced nursing*, **1997**, 26(3): 623-630.
54. Zhang Jie, Liu Dan, Chen Xiangyi, et al. Application of programmatic version of grounded theory in psychological counseling training research. *Chinese Journal of Mental Health*, ***2012***, *26(9): 648-652.*
55. Fontana A, Frey J. The art of science. *The handbook of qualitative research*, ***1994***, 361376.
56. Zheng Zhen. Synthesis of Sociological Methods—Taking Questionnaire and Interview as Examples. *Social Sciences*, ***2016*** (11): 93-100.
57. Meng Hui. Research interview and its application status and prospect. *Psychological Science*,***2004***(05):1202-1205.
58. Aspers P, Corte U. What is qualitative in qualitative research. *Qualitative sociology*, ***2019***, 42: 139-160.
59. Ma X, Ma XZ. Tourist Experience Based on Guangzhou Tourism Market Survey. J.S*un Yatsen University Forum. 1007-1792. (**2006**).*
60. Shi X, Niu Y. Exploring Chinese and American tourists' perceptions of food tourism in Beijing based on user reviews. *Modern Urban Studies* .08(**2022**):122-129.
61. Yang C, Fen M. A study on the image of Chengdu's cuisine based on tourists' perceptions. *Gastronomic research* 36.04(**2019**):15-22.
62. Zhu C, Hou ZQ. Tourism Destination Image Perception Based on IWOM - Xiamen City as an Example. *Tropical Geography*. 33.04(**2013**):489-495. doi:10.13284/j.cnki.rddl.002363.
63. Kvalsvik F, Øgaard T. Dyadic interviews versus in-depth individual interviews in exploring food choices of Norwegian older adults: A comparison of two qualitative methods. *Foods*, ***2021***, 10(6): 1199.
64. Zhang PP. A study on food waste behaviour of restaurant consumers in tourist cities.Resource Sciences. 40, 1186–1195 (**2018**).
65. Weed M. Research quality considerations for grounded theory research in sport & exercise psychology. *Psychology of sport and exercise*, *2009*, 10(5): 502-510.
66. Zhongming Z, Linong L, Xiaona Y, et al. UNEP food waste index report **2021**.
67. Capstick S, Khosla R, Wang S, et al. Bridging the gap–the role of equitable, low carbon lifestyles. *UNEP.(2020). The Emissions Gap Report*, ***2020***.
68. Zhou Rongting, Li Pei, Zhou Shihan. Research on the Dynamic Mechanism and Path of Virtual Reality Publishing Development *Publishing Science*, ***2023***, *1-10*
69. Draucker C B, Martsolf D S, Ross R, et al. Theoretical sampling and category development in grounded theory. *Qualitative health research*, ***2007***, 17(8): 1137-1148.
70. Zhou Qing, Wu Tongzhen, Yang Wei, Liang Yao. Research on the Driving Factors and Functional Mechanism of the Enterprise Technology Standards Alliance Facing the "Belt and Road"——Based on the Fusion Method of Text Mining and Procedural Grounded Theory. *Nankai Management Review*, ***2021***,*24(03):150-161.*
71. Ernst M O, Banks M S. Humans integrate visual and haptic information in a statistically optimal fashion. *Nature*, ***2002***, 415(6870): 429-433.

72. Zhang, X.; Cao, S.; Pan, Y. The Relationship between the Use of Non-Verbal Information in Communication and Student Connectedness and Engagement in Online Design Education. *Sustainability* **2022**, 14, 15741. https://doi.org/10.3390/su142315741
73. Fund E D. Methane: A crucial opportunity in the climate fight. *Environmental Defense Fund.* Available online at: https://www. edf. org/climate/methane-crucial-opportunity-climate-fight, **2021**.
74. Porter S D, Reay D S, Higgins P, et al. A half-century of production-phase greenhouse gas emissions from food loss & waste in the global food supply chain. *Science of the Total Environment*, **2016**, 571: 721-729.