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Exploring Influencing Factors and Driving Mechanisms of Public Low-Carbon Behavior in the Internet Context: An Exploratory Study Using Grounded Theory

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Abstract. With the rapid development and extensive integration of the internet into various low-carbon scenarios, Participation in low-carbon behaviors through internet platforms has increasingly become an important means for public participation in environmental co-governance. To delve into the influencing factors and driving mechanisms of public low-carbon behavior under the internet context, this paper uses the "Ant Forest" internet green public welfare project as a case study, and employs grounded theory to conduct a three-tier coding analysis coding analysis on the interview materials of the project's users. This analysis is utilized to construct a theoretical model of the driving mechanism of public low-carbon behavior in an internet context. The study finds that platform interaction mechanism, psychological satisfaction effect, public welfare group identification, and individual behavioral habit are key factors driving public low-carbon behavior. These factors interactively influence the modes and extent of public participation in low-carbon behavior. The research conclusions contribute to promoting interdisciplinary cross-studies and enriching the related behavioral theoretical system. At the same time, they provide theoretical support and strategic recommendations for further driving public low-carbon behavior.

Keywords: Internet; Public Low-Carbon Behaviour; Influencing Factors; Driving Mechanisms; Grounded Theory

1. Introduction

With the continuous global warming leading to various natural disasters that pose serious threats to human life and property safety, most countries have gradually reached a consensus to reduce greenhouse gas emissions through global agreements. As the largest developing country globally, China actively participates in global carbon reduction actions, pledging in 2020 to strive to achieve "carbon peak" before 2030 and "carbon neutrality" by 2060, the so-called "dual carbon" goal. However, the lack of sufficient motivation for public low-carbon behavior severely restricts the realization of China's "dual carbon" goal. According to the survey results of the "Citizen Ecological Environment Behavior Report" released by the Chinese government in the past three years, there is a considerable gap between the practice and cognition level of public low-carbon behavior. For example, the 2020 survey results showed that 94.4% of respondents believe that "personal attention to ecological environment information" is important for protecting the ecological environment, and 45.9% of respondents "often" or "always" pay attention to ecological environment information. The number of practitioners is less than half of those cognizant. Overall, public low-carbon behavior presents a situation of "high cognition, low practice" (Lu et al., 2020). Therefore, how to solve the problem of insufficient motivation for public low-carbon behavior has become a critical question that needs to be answered currently.

In recent years, the digital revolution based on the internet has created new business opportunities and immense business value (Scuotto et al., 2020). Some innovative companies have seized the opportunity of the information technology explosion, using new digital technologies to embed environmental, social, and economic fields and continuously innovate in all sectors (Franceschelli et al., 2018). When Internet platforms venture into the green public welfare field, they attract a large number of users to participate in low-carbon activities with their powerful algorithms and incentive mechanisms. The emergence of these platforms not only expands the practice scenarios of public low-carbon behavior but also reshapes the practice logic of public low-carbon behavior. It makes behaviors that were impossible under traditional technology conditions possible, greatly enhancing the enthusiasm for public low-carbon behavior and achieving significant economic and social benefits. Therefore, it is necessary to conduct an in-depth analysis of the influencing factors and driving mechanisms of public low-carbon behavior under the internet background. This research incorporates the internet as an important variable into the analytical framework, discussing the impact of the internet on changes in information dissemination methods and public behavior interaction patterns. This aspect shows quite obvious characteristics of communication studies, sociology, psychology, and management science, which will promote interdisciplinary cross-studies and further enrich the related behavioral theoretical system. In addition, this study provides ideas and methods to further drive public low-carbon behavior, contributing to the advancement of China's "dual carbon" goal.

2. Literature Review

Following the Second Industrial Revolution, industrial production, resource development, and excessive consumption have exacerbated harmful effects on the environment (Thøgersen & Crompton, 2009). People began to realize the impact of human behavior on the environment, but there was a lack of knowledge about how people interacted with the environment until the mid-1960s when environmental behavior was formally studied. Initially, due to scholars researching environmental behavior from different disciplinary fields and theoretical perspectives, no consensus was reached on the question of "which variables are most related to environmental behavior" (Li et al., 2019). Over the past decade, carbon emissions caused by human activities have had a massive impact on the climate and the survival of flora and fauna. How to incentivize and constrain human production and living behaviors to achieve the goal of reducing carbon emissions has become the focus of current research across disciplines. Thus, exploring the influencing

factors of low-carbon behavior and probing its mechanisms of action have become the most interesting topics in academia (Wang & Wu, 2015).

A review of existing literature reveals three categories of variables significantly impacting public low-carbon behavior. First, demographic variables include gender, age, type of residence, education level, income, etc. (Botetzagias et al., 2015). For instance, a positive correlation exists between female disposition and low-carbon behavior (Park et al., 2007). There's an inverse relationship between an individual's age and their enthusiasm for low-carbon behavior (Freymeyer & Johnson, 2010), while income and education level play critical roles in public willingness for low-carbon behavior (Kaur et al., 2022).Second, individual psychological variables include environmental cognition, awareness, emotion, motivation, values, and attitudes, etc. (Liu et al., 2021). With the development of behavioral psychology, the exploration of individual psychological factors has become the focus of low-carbon behavior research, leading to substantial findings. Scholars have found that people's environmental consciousness can spark friendly attitudes towards the environment and active engagement in practices (Tran, 2021; Yang et al., 2022). The impact of environmental attitudes on behavior depends on promotion and education (Mu et al., 2022). Some research suggests that ecological value cognition positively impacts low-carbon behavior directly and indirectly, where indirect influence is mediated by environmental attitudes (Meng & Si, 2022). Individual differences in cognitive control regulate the relationship between environmental attitudes and behavior (Langenbach et al., 2022). Third, situational variables refer to external factors affecting individual low-carbon behavior choices, other than individual factor variables. For example, social norm interventions would encourage a shift in low-carbon behavior intent and actions (Lede et al., 2019), effectively inducing significant changes in low-carbon behavior (Farrow et al., 2017). Specifically in the realm of low-carbon consumption, the societal consumption culture mediates between low-carbon consumption attitudes and behaviors. When low-carbon consumption becomes a mainstream culture, it enhances the influence of low-carbon consumption attitudes on low-carbon consumption behavior, guiding more consumers to choose low-carbon consumption (Ma & Men, 2022). Certainly, personal and situational factors interact, with personal factors often changing due to situational influences. Situational factors regulate the relationship between environmental consciousness and pro-environmental behavior of individuals, where favorable (unfavorable) situational factors will promote (hinder) this relationship. Initiatives by peers, government, and non-governmental organizations can significantly impact individual attitude-driving factors, such as environmental knowledge and environmental concerns (Kumar et al., 2019).

The emergence of the Internet has revolutionarily altered the ways in which human beings interact with their environment. (Wang & Hao, 2018). In recent years, with the rapid development of information technology, the scenarios of internet technology embedded in green low-carbon life are increasing. The natural technology spillover effect of internet technology in the field of environmental protection makes it very significant in promoting public participation in low-carbon behavior. Some scholars have studied the impact of internet usage on individual environmental behavior using data from the China General Social Survey and found a significant positive correlation between them (Gong et al., 2020). Internet usage not only directly affects pro-environmental behavior, but also indirectly influences pro-environmental behavior through the mediating roles of environmental knowledge, perceived environmental pollution threats, and satisfaction with environmental protection. Among these mediating roles environmental knowledge and perceived environmental pollution threats are positive, while satisfaction with environmental protection is negative (Liu et al.,2021). The internet serves as an independent variable in many relevant studies, and as a mediating or moderating variable in others. For example, some research suggests that the internet promotes residents' low-carbon behavior and enhances residents' overall level of environmental awareness through mediating factors of residents' low-carbon behavior (Yang et al.,2022). In terms of green consumption, based on the framework of the Theory of Planned Behavior, some scholars found that online

media promotes green consumption through two paths. One is a moderating effect, whereby internet usage promotes the conversion of intention into action and perceived behavioral control into action, thereby reducing the gap between intention and behavior. The second is a mediating effect, where internet usage promotes green consumption behavior through the mediating role of individual perception of environmental threats (Wang et al., 2022).

In the era of "Internet+", the combination of environmental protection public welfare and Internet technology has become a trend. Various online platforms use Internet technology to construct innovative public welfare environmental promotion mechanisms to disseminate the concept of low-carbon living, bringing an innovative transformation to China's environmental protection cause. Some Internet companies, with their powerful algorithms and large user groups, design ingenious incentive mechanisms and create a series of green public welfare projects that effectively enhance the public's enthusiasm for participating in low-carbon behaviors, such as "Ant Forest" and "QingShan Plan". Therefore, deeply exploring the influencing factors and mechanisms that drive public low-carbon behavior in these projects has become a new topic of concern in academia. Some research suggests that the reason these projects can enhance the public's enthusiasm for participating in low-carbon behaviors is mainly due to the gamification mechanism. Because the characteristics of gamification, such as completeness, continuity, and interactivity, can enhance user stickiness and motivate user participation (Li & He, 2019). This gamified design can be migrated to the field of environmental protection (Seaborn & Fels, 2015; Hamar & Dias, 2018), driving public low-carbon behavior by stimulating user competition preferences (Huang & Zhou, 2020) and pleasure experiences (Mi et al., 2021). The driving mechanism of gamification is mainly reflected in three aspects: task-driven, interaction-driven, and social-driven (Ning et al., 2021)."Ant Forest" is the most typical green public welfare project using gamification strategies. It combines low-carbon propaganda with games, changes the previous dissemination methods, and allows the public to have a clearer understanding of low-carbon emissions reductions in entertainment (Hu & Zhang, 2018). Under the drive of the game mechanism's attraction and individual curiosity and interaction needs, the more an individual participates, the more environmental behaviors they have in daily life (Zhang et al., 2022).

Existing research results have provided a rich theoretical basis and research perspective for this field to a large extent, but there are still some shortcomings:(1) Most of the literature mainly uses quantitative research methods, using structured scales to conduct large sample surveys on public low-carbon behavior. Traditional quantitative research often results in inconsistent conclusions drawn by different researchers, or even contradictions. This is because traditional quantitative research has a significant limitation, that is, it regards independent variables as separate causes that produce survey results (Ragin, 2009), so it lacks explanatory power for phenomena or facts in reality that are influenced by complex multiple factors. (2) Most existing research focuses on examining the impact of individual factors on public low-carbon behavior, but there is a lack of in-depth discussion about the logical relationships and mechanisms of action between various influencing factors. (3) Compared with the current situation of vigorously developing Internet green public welfare projects, the academic community lacks attention to this field.

Based on the above analysis, this article tries to make up for these shortcomings through in-depth research. Taking "Ant Forest", the world's largest individual carbon account platform, as a case study and using grounded theory research methods, this paper attempt to answer the following questions: What are the key factors driving public low-carbon behavior in the context of the Internet? What logical relationships exist between these factors? How to construct a theoretical model of the public's low-carbon behavior driving mechanism with realistic explanatory power?

3. Research Method

3.1. Sample Selection

"Ant Forest" is a green internet public welfare project launched by Alibaba Group in 2016. It is the first individual "carbon account" in China. This project uses internet technology to organically combine online and offline scenarios, uses scientific carbon footprint accounting methods to record users' low-carbon behaviors, and provides feedback to users on their low-carbon behavior achievements in a visualized way.

Users of "Ant Forest" can plant a small tree seedling on the virtual interface of the internet. At the same time, they can obtain "green energy balls" to water the virtual tree online through low-carbon behaviors in daily life such as online payment, green travel, and recycling of old things. Once the virtual tree grows, the Ant Group will plant a real tree for users in reality. This project encourages users to actively participate in low-carbon behaviors in daily life, effectively achieve energy conservation and emissions reduction, and continuously assist China's "dual carbon" goal. By the end of 2021, "Ant Forest" has driven more than 600 million people to practice green low-carbon behaviors, planted over 326 million real trees in desertified areas, and the total planting area has exceeded 3.97 million acres (Ant Group, 2023). Therefore, "Ant Forest" is very representative among the current internet green public welfare projects. Therefore, it is scientific and reasonable to select "Ant Forest" as the research case in this article.

3.2. Research Methods and Data Sources

Grounded Theory is a mainstream qualitative research method that has been widely recognized by academia in recent years. Its basic tenet is to build theory on the basis of empirical data (Strauss, 1987), a process embodied in the three-tier coding process of Open Coding, Axial Coding, and Selective Coding. Specifically, it involves decomposing the collected text materials, identifying phenomena, conceptualizing the phenomena, and then re-abstracting, elevating, and integrating the concepts into categories and core categories in an appropriate way. Then the categories and the relationships between them are developed to ultimately construct a new theory (Hoffart, 2000). (Fig.1)

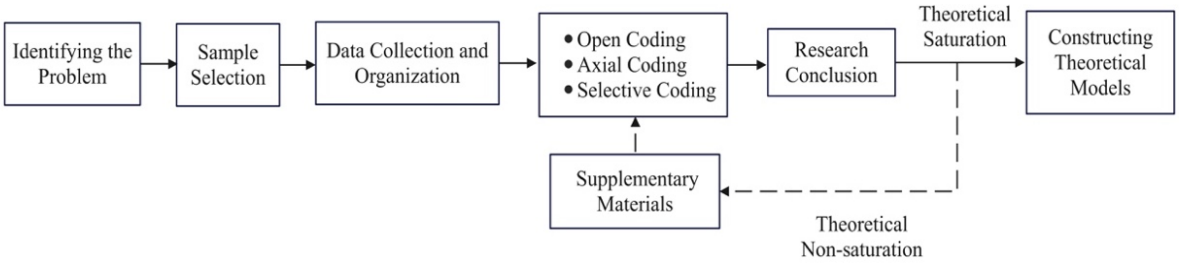

Fig. 1: Flow Chart of Grounded Theory Method (Pandit, 1996)

The interview is an important part of obtaining coding material. In this paper, semi-structured interviews were used to conduct in-depth interviews with "Ant Forest" users. College students were mainly selected as interviewees because they are the primary participants of "Ant Forest". Moreover, this group has characteristics such as active thinking, strong information reception ability, and strong behavior perception ability, etc. (Ren et al., 2019), and they can better summarize and state their feelings and behaviors. Therefore, interviewing this group facilitates the collection of more specific and rich materials. In addition, the selected interviewees all have rich experience in participating in "Ant Forest" (received protection for 3 or more areas, or have successfully planted trees and participated for more than one year). Theoretical sampling was used when selecting interviewees. Unlike traditional random or convenience sampling, the purpose of theoretical sampling is to develop and refine the theory being constructed. The process of theoretical sampling is iterative and dynamic. With the deepening of the research, multiple

rounds of sampling may be conducted repeatedly until the construction of the theory reaches saturation (Glaser & Strauss, 1999). According to the principles of theoretical sampling, the 25 interviewees chosen for this paper were not drawn at once. Instead, during the process of data collection and analysis, the next interviewees were selected based on the already analyzed data and the preliminary theories or concepts that had been formed. The basic information of the 25 interviewees drawn is shown in Tab.1.

Table 1: List of Basic Information of Interviewees

Respondent Number	Interviewee	Gender	Age	Occupation	Participation in Outcomes
A01	Miss Liu	female	21	College student	1 tree, 16 protected plots
A02	Miss Chen	female	22	College student	4 protected plots
A03	Mr. Lai	male	20	College student	5 protected plots
A04	Mr. Chen	male	21	College student	4 protected plots
A05	Mr. Song	male	21	College student	8 protected plots
A06	Miss Zeng	female	21	College student	1 tree, 16 protected plots
A07	Mr. Wen	male	20	College student	2 trees, 32 protected plots
A08	Miss Wang	female	20	College student	3 protected plots
A09	Miss Cheng	female	20	College student	1 tree, 5 protected plots
A10	Miss Wang	female	20	College student	1 tree, 8 protected plots
A11	Miss Zhu	female	20	College student	9 protected plots
A12	Miss Cao	female	20	College student	7 protected plots
A13	Miss Le	female	20	College student	1 tree, 12 protected plots
A14	Mr. Liu	male	21	College student	1tree, 12 protected plots
A15	Miss Mo	female	22	College student	39 trees, 30 protected plots
A16	Miss Zhou	female	21	College student	7 trees, 21 protected plots
A17	Miss He	female	20	College student	1 tree, 3 protected plots
A18	Miss Chen	female	21	College student	15 protected plots
A19	Mr. Chen	male	22	College student	6 protected plots
A20	Mr. Chen	male	21	College student	1 tree, 24 protected plots
A21	Miss Li	female	21	College student	4 protected plots
A22	Mr. Zhang	male	21	College student	2 trees, 17 protected plots
A23	Mr. Chen	male	22	College student	5 protected plots
A24	Miss Feng	female	21	College student	7 trees, 9 protected plots
A25	Mr. Xu	male	22	College student	1 tree, 3 protected plots

Based on the research objectives and plans of this article, this article initially drafted an interview outline. To ensure the effectiveness and scientific nature of the interview outline, we conducted a pre-interview with six interviewees based on the initial interview outline, and then evaluated the quality of the interview outline based on the pre-interview situation to further improve the interview outline. Before the interview, we familiarized the interviewees with the interview outline to ensure that they had sufficient time to think, and recorded the interview process with their consent. To ensure the effectiveness of the interview, each interview time was controlled to be more than 20 minutes. During the interview, the interviewer conducted one-on-one, face-to-face in-depth interviews with the interviewees based on the interview outline and responded promptly to the interviewees' answers. The interviewer adjusted the interview questions flexibly according to the progress of the interview in order to deeply explore a valuable question and collect more representative materials. The interview process maintained a friendly and relaxed atmosphere, making the interviewees more willing to express their feelings and state details. After the interview, we converted the audio material into text material, and got more than 120,000 words of interview text material. On the premise of retaining the original intentions of the interviewees to the greatest extent, the text materials were

processed and organized, so as to provide convenience for the smooth implementation of open coding, axial coding and selective coding.

4. Results and Discussion

4.1. Open Coding

Open coding is the process of breaking down interview text material, tagging original sentences, obtaining initial concepts from original sentences, and then categorizing the inductive concepts. In order to reduce the interference of the researcher's personal subjective factors, we tried to use the original words of the interviewees as tags to excavate initial concepts, and eventually extracted more than 540 original sentences and their corresponding initial concepts. Since the initial concepts are very complex and there is a certain degree of overlap between the concepts, the initial concepts are further categorized. At the same time, we only selecting concepts that were repeated more than three times (including three times), and eliminating concepts that contradicted each other (Wang & Wang, 2022). In the end, several initial concepts and categories were refined. Due to the limited length of the paper, only 2-3 representative original sentences are shown for each category (Tab. 2).

Table 2: Categorization of Open Coding

Category	Original statement（Initial concepts）
Reminder feature	A1: Due to the platform's push notifications, I would enter upon seeing these alerts. (System Push) A2: If there is a reminder, I would click to open it. (Reminder Feature) A7: I enable the reminder function, occasionally checking in—for instance, when the energy is full, I would enter the platform to collect energy. (Reminder Feature)
Game functions	A4: The gamification feature is interesting and feels novel. (Novelty) A13: I quite enjoy this gamification feature. It's more about fun rather than competition, so it feels quite casual. (Casual Gameplay) A17: I find the energy collection quite fun. Because the energy balls drop very quickly, collecting them is like training my speed and patience. (Fun Aspect)
Popular science function	A11: The platform's information on flora and fauna has exposed me to many different animals and plants I have never seen before. (Knowledge Acquisition) A16: Inside the Ant Forest, I can learn about wildlife. Moreover, unlocking certain animal pictures helps me find more energy. (Continuous Learning) A17: It helps me learn more about different species, habitats, and other environmental knowledge. (Knowledge Expansion)
Public welfare function	A3: I believe planting trees in the desert is quite meaningful. Therefore, I wish to plant a tree and participate daily. (Perception of Public Good) A4: In terms of public welfare, I think it's meaningful. It allows us to collectively participate in environmental governance. (Environmental Participation) A18: The motivation behind my persistence is the desire to plant a Populus euphratica tree, which can improve the desert environment for a long time. (Environmental Protection)
Connectivity function	A5: The platform's different interfaces prompt each other since they are interconnected, and you would occasionally switch to another interface. (Interconnected Interfaces) A7: When I click into "Baba Farm," I would incidentally collect the energy from the Ant Forest. (Unhindered Use Between Interfaces) A13: The integration between "Ant Forest" and "Ant Manor" is quite tight because they are both in the same interface, making it convenient to switch. (Program Integration)
Emotional interaction	A4: The most significant purpose is to maintain emotional connections between friends and family. Our interactions have increased compared to before. Not only through WeChat or calls, Ant Forest in Alipay can also become a small platform for interaction, enhancing our bonds. (Strengthening Emotional Connection) A15: Through the "stealing energy" process, I can interact with friends in a playful way. (Promoting Friend Connections) A14: When I forget to collect energy, my friends would remind me, increasing the interaction between my friends and me. (Friend Reminders)
Group effect	A15: I joined a "Ant Forest" WeChat group. Friends in the group are enthusiastic about tree planting, motivating me to persist. (Peer Influence)

	A18: In fact, if only one person participates in this project, it would be less fun. It is more interesting when everyone plays together. So I think it's better to play with friends. (Interactive Fun) A25: In the future, I will continue to participate, especially since a group of my friends are all playing. We have added each other as friends, and we collect energy and water trees on the platform together, co-planting trees. (Peer Interaction)
Social function	A2: A friend of mine co-planted a "Couple's Tree" with his girlfriend before, and I found it quite meaningful. I also think the "Friends and Family Tree" is quite meaningful. (Social Topics) A8: During a school club activity, the senior students were discussing the Ant Forest project. Everyone decided to add each other as friends on the platform, and then we began interacting on the platform. (Social Pathway)
Competition	A4: In a way, the leaderboard stimulates my competitive spirit, encouraging me to open the "Ant Forest" daily to collect energy. This leaderboard could motivate me. Also, there is a "vs" feature that brings competition, and next time I might be more motivated to compete with others. (Competitiveness) A22: Personally, I enjoy competition, and my energy collection has always been at the top of the leaderboard. In the ranking, I am far ahead of the second place. (Pride)
A sense of accomplishment	A2: I get a sense of accomplishment seeing the tree planting number going from 0 to 1—it's a feeling of creating something from nothing. (Self-Accomplishment) A9: If I plant a tree on the "Ant Forest" platform, the tree will bear my name, which I think is quite cool. (Exclusive Achievement) A15: Each time I unlock a tree type, the platform would award me a certificate. This gives me a sense of achievement during the process. (Symbolic Incentives)
Goal-driven	A9: I always want to plant a tree called Populus euphratica. (Clear Goal) A11: To achieve the goal of planting a Haloxylon tree, I accumulate energy daily. (Strong Goal) A11: I think tree planting is like collecting stamps. Once you've reached this goal, there will be a higher goal to aim for. (Medium- to Long-term Goals)
A sense of environmental mission	A13: Although I might never have the chance to visit the place where the trees are planted in my lifetime, it feels like I've made my own contribution there. (Environmental Contribution) A10: It's not so much that "Ant Forest" sparked my interest in environmental protection, as I've always been concerned about this area. (Sustained Environmental Concern) A8: The existence of "Ant Forest" is for environmental protection, which is quite meaningful. (Environmental Significance)
Habit formation	A2: I open "Ant Forest" every morning, because that's usually when energy is available. (Frequency of Use) A13: The significance of "Ant Forest" is the joy of rising early, because energy usually matures around seven in the morning. This is just when I wake up. I collect the energy while getting up, which brings me happiness. (Habitual Behavior)
Behavioral preference	A16: I try to plant different types of trees, planting one of each kind. (Tree Collection) A15: I want to light up the mark of each tree type. (Lighting Achievements) A19: For each tree I've planted, there will be a small seedling planted under that tree. I want to collect all these tree seedlings. (Planting a Variety of Tree Types)
Recreation time	A2: It's like browsing WeChat Moments. I'd check it out whenever I have spare time. Since it only requires a few casual clicks, I often click to take a glance. (Aimless) A17: I think participating in "Ant Forest" doesn't take much time, just a few minutes. I see it as a pastime. (Leisure Pastime)

4.2. Axial Coding

Axial coding is the process of finding correlations between categories and concepts, and then developing a main axial category, which is then analyzed in depth. This study compares the logical relationships of the above 15 open coding categories, analyzes their causal and correlative relationships, and thereby inducts 4 main categories. The main categories and their corresponding open coding categories are shown in Tab.3.

Table 3: Main Categories Formed by Axial Coding

Principal category	Corresponding category	Connotation of relationship
Platform interaction mechanism	Reminder function	The platform's design of reminder features enhances the continuity of user participation.
	Game functions	The platform's gamified mode of entertainment attracts sustained user participation, while improving user stickiness.
	Popular science function	Users can learn about relevant low-carbon environmental knowledge on the platform, thereby enhancing user-platform interaction.

	Public welfare function	The platform's public welfare attribute attracts users to participate, forming an interactive relationship between users and the platform based on public welfare actions.
	Connectivity function	Interconnected pages for different projects on the platform facilitate communication and user flow among various projects.
	Social function	The platform offers interactive methods for users to connect socially with friends and family.
Public welfare group identification	Group effect	Encouraged by friends and the platform's public welfare initiatives, users can develop a sense of public welfare.
	Emotional interaction	Utilizing the platform's bonding feature, users can strengthen emotional connections with relatives and friends while enhancing their sense of belonging to public welfare groups.
Psychological satisfaction effect	Competition	The platform's competitive ranking mechanism stimulates users' competitive drive, subsequently increasing usage frequency and promoting psychological satisfaction.
	A sense of achievement	Users receive relevant rewards, fostering a sense of accomplishment.
	Goal-driven	User behavior is driven by specific objectives, with the attainment of relevant goals yielding psychological satisfaction.
	A sense of environmental mission	The process of user participation promotes a sense of environmental protection mission, satisfying individuals' "altruistic" psychology.
Individual behavioral habit	Habit formation	Habitual behaviors, such as usage frequency and duration, influence the sustainability of individual low-carbon behavior.
	Behavioral preference	Users' behavioral preference contribute to sustained motivation.
	Recreation time	The platform's entertainment mode has emerged as a significant avenue for users to spend their leisure time.

4.3. Selective Coding

Selective coding refers to the process of selecting a core category from the main categories that have been discovered, analyzing the correlation between the core category and the main categories, and describing the process of behavior generation in a "storyline" format. After completing the storyline link, this study forms a new theoretical framework. The main relationship structure of the main categories is shown in Tab. 4.

Table 4: Primary Relationship Structure of Main Categories

Mechanism → behavior	The platform's interactive mechanism serves as both an antecedent and a direct condition, directly influencing the public's engagement in low-carbon behavior.
Public welfare group identification ↓ Mechanism → behavior	Public welfare group identification, functioning as an external intervention factor, influences the endurance of public motivation for low-carbon behavior.
Psychological satisfaction effect ↓ Mechanism → behavior	Psychological satisfaction effect is an internal contextual condition that affects the intensity of public low-carbon behavior drive.
Individual behavioral habit ↓ Mechanism → behavior	Individual behavioral habit is a follow-up action that affects the durability of the public's drive to low-carbon behavior.

This study has identified the core category of "Driving Mechanism of Public Low-carbon Behaviors". The main relationship structure around the core category can be summarized as: Platform Interaction Mechanism, Public Welfare Group Identification, Psychological Satisfaction Effect, and Individual

Behavior Habit, all of which have significant impacts on the drive of public low-carbon behaviors. The results of selective coding are shown in Fig.2.

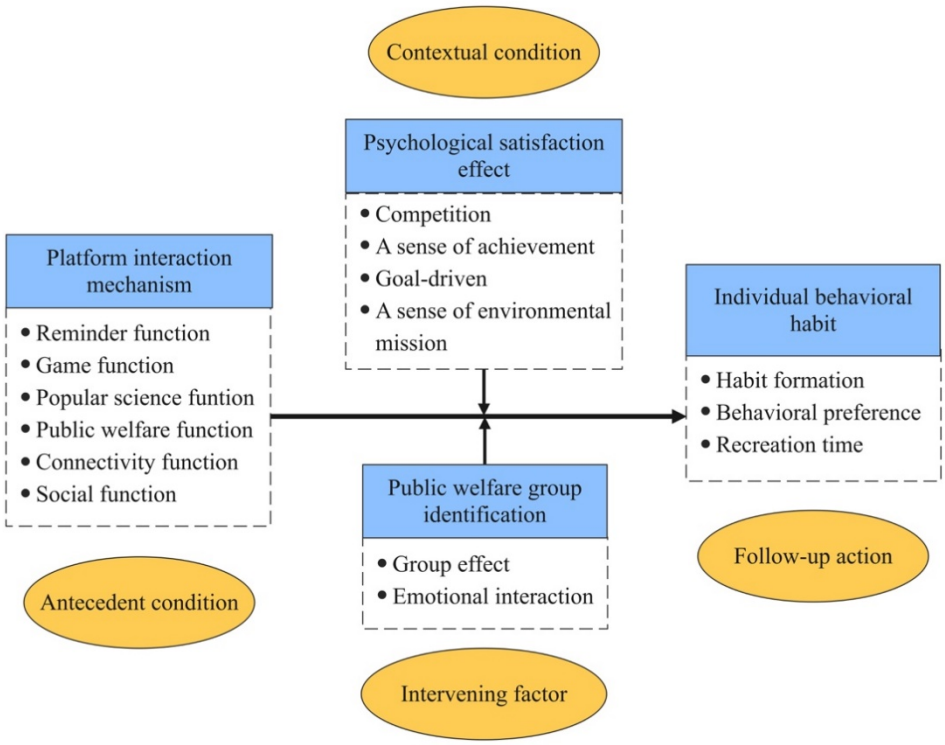

Fig. 1: Theoretical Model of the Driving Mechanism for Public Low-Carbon Behavior in the Context of the Internet

4.4. Text of Theoretical Saturation

During the process of conducting interviews and coding, when the number of interviewees reached 22, no new conceptual categories emerged. To ensure the validity of the research, the number of interviewees was increased to 25. When no new conceptual categories still emerged, it could be considered that the research had reached theoretical saturation.

4.5. Explanation of the Driving Mechanism Model of Public Low-Carbon Behavior

The platform interaction mechanism, consisting of reminder functions, game functions, science popularization functions, public welfare functions, connectivity functions, and social functions, serves as the antecedent and direct conditions driving the public's low-carbon behavior. Specifically, game functions, science popularization functions, and public welfare functions are internal factors of the platform interaction mechanism. The science popularization function can enrich the public's environmental knowledge, serving an educational role and promoting the public's engagement in sustained low-carbon behavior. This notion has been corroborated in many studies, such as "Vitality Conservation"(Kaplowitz et al., 2012) and "Extending Individual Learning of Low-carbon Lifestyles Can Promote Personal Practice of Low-carbon Behavior"(Aziz et al., 2015). The reminder function and social function are external factors of the platform interaction mechanism. The internal factors of the platform interaction mechanism are fundamental; the interactions among the functions attract public participation and directly foster low-carbon behavior. The external factors of the platform interaction mechanism supplement the internal factors, indirectly promoting low-carbon behavior among the public. The stimulation of the external factors makes

the public aware and knowledgeable of the internal factors, thereby mobilizing the public's enthusiasm for engaging in low-carbon behavior. The statements from the interviewees can confirm the above viewpoints, such as: "The Ant Forest and the Ant Manor are well integrated, as they are both in the same interface, which makes switching very convenient" (Interviewee A13); "Because the platform system pushes notifications, I will click in when I see these notifications" (Interviewee A1).

The internal and external factors of the platform interaction mechanism work jointly to directly promote low-carbon behavior among the public. Among them, the internal factors serve as the foundation; when the functionalities of the internal factors are comprehensive, they directly boost the public's participation in low-carbon behavior. Conversely, if the functionalities of the internal factors are overly complex, they can dampen the public's enthusiasm for participating in low-carbon behavior. Thus, the number and operation of the internal factor functionalities have a certain "threshold". The external factors complement and develop the internal factors, indirectly influencing public decision-making regarding low-carbon behavior. However, this influence is transient, and as the novelty of the low-carbon behavior projects for the public decreases, the impact of the external factors gradually diminishes. Therefore, it is particularly important for the platform to continually design different forms of external factors to maintain the freshness of public participation.

Public welfare group identification (determined by group effect and emotional interaction) serves as an external intervention factor driving the public's low-carbon behavior, affecting the persistence of such behavior. Public welfare group identification refers to the phenomenon where individuals, initially passively participating in platform low-carbon behavior under the influence of friends and family, gradually develop an emotional dependency on the group and identify with the group's public welfare behavior, thereby increasing the likelihood of actively participating in low-carbon behavior. This viewpoint highly coincides with the core view of the Theory of Planned Behavior, which holds that individual behavior is influenced by attitudes towards the behavior, social norms of the behavior, and perceived behavioral control (Ajzen, 1991). Generally, the higher the individual's degree of identification with the public welfare group, the longer the persistence of their participation in platform activities. As one interviewee (Interviewee A25) stated, "In the future, I should continue to participate, after all, a group of friends around me are playing. We have also added friends, usually collect energy from each other, water trees on the platform, and jointly plant trees." Furthermore, emotional exchanges within the public welfare group cannot be ignored. When participants interact frequently with their friends and family on the platform, the platform acts as a bond for their emotional interactions, prompting participants to develop a sense of belonging and dependency on the platform, further enhancing the persistence of their low-carbon behavior.

The psychological satisfaction effect (determined by competitiveness, a sense of achievement, goal drive, and a sense of environmental mission) serves as an internal contextual condition driving the public's low-carbon behavior, impacting the intensity of individual low-carbon behavior. The psychological satisfaction effect, according to the Uses and Gratifications theory, implies that individuals will choose and use specific media or products based on the satisfaction they experience from their use (Katz et al, 1973). Satisfaction is the subjective feeling when an individual's needs are fully met. Users can gain pleasure and thus psychological satisfaction through platform interaction mechanisms, which in turn stimulates their further participation. This viewpoint highly aligns with the research conclusions of relevant scholars，that public awareness of environmental protection can inspire them to adopt a friendly attitude towards the environment and demonstrate proactive behavior(Pham & Khanh, 2021). As one interviewee (Interviewee A10) stated, "Rather than saying that Ant Forest has sparked my interest in environmental protection, it's more that I've always been paying attention to environmental protection."

Individual behavioural tendencies—which are determined by ingrained habits, behavioural preferences, and leisure time—act as the catalyst for subsequent public low-carbon actions, thereby influencing the sustainability of these actions. These behavioural tendencies signify individual low-carbon behavioural drivers that possess unique characteristics. Different dominant patterns variably affect the sustainability of individual low-carbon actions. Within these differing patterns, the durability of individual low-carbon actions, from strongest to weakest, can be ordered as follows: ingrained habits, behavioural preferences, and leisure time.

Low-carbon behaviours predominantly guided by leisure time display the weakest sustainability. This vulnerability arises due to the substantial influence of unpredictable factors on an individual's leisure time, such as personal initiative, the ease of platform accessibility, and the disposability of time (Niemeyer, 2010). Behavioural patterns primarily steered by preferences yield marginally more sustainable low-carbon behaviours. These preferences hinge not only on individual initiative but also on symbolic rewards provided by platforms, such as diverse tree species, conservation areas, and badges. If a platform offers a limited quantity of tree species and conservation areas, diminishing the scope for collection, it may weaken user preferences, thereby affecting the persistence of participation. Conversely, if a platform provides an extensive and diverse range of tree species and conservation areas, behavioural patterns driven by preferences may gradually transition to patterns dominated by ingrained habits. Habits-driven low-carbon behavioural patterns exhibit the highest sustainability. Under this model, individual low-carbon actions are less prone to external disturbances; individuals develop an emotional dependency on low-carbon actions and form habitual behaviours, integrating these actions into their daily lives.

From the aforementioned model analysis, two insightful conclusions can be gleaned: (1) The role of platform interaction mechanisms, as a prerequisite condition, is pivotal as it directly determines the variety of platform functionalities. On the one hand, the degree of feature completeness and the diversity of function types impact user engagement in the subsequent phases. On the other hand, the level of interactivity between platform features and users also influences their continued usage. When the platform introduces related activities to enhance user interaction, User engagement has increased significantly. (2) Public welfare group identification, acting as an external intervening factor affecting public low-carbon behaviours, has either direct or indirect connections with various elements. On the one hand, as this identification is further internalised, users are more strongly driven by their intrinsic environmental consciousness, and their sense of personal environmental responsibility intensifies. As an individual's sense of environmental duty progressively amplifies, habits-driven low-carbon behavioural patterns form, further augmenting the sustainability of individual low-carbon actions. On the other hand, founded on platform interaction mechanisms and philanthropic group identification, individuals derive pleasure from their participation in the platform. This enjoyment confers a sense of psychological fulfilment, which in turn bolsters their motivation to participate.

5. Conclusion

This study, employing "Ant Forest" as the research subject, applies grounded theory to conduct a three-tier coding analysis of project user interview materials, constructing a theoretical model of the driving mechanism for public low-carbon behaviour in the context of the internet. This research further corroborates the conclusions of other scholars' studies, specifically, the driving role cognitive factors, environmental responsibility awareness, and internet mediums play in public low-carbon actions. However, distinct from previous studies, this paper, through the use of grounded theory, has uncovered certain logical relationships among these factors, with each relationship exerting different mechanisms on public low-carbon behaviour. Namely, platform interaction mechanisms—determined by alert, game, science popularisation,

philanthropic, connectivity, and social features—are both the antecedent and direct conditions driving public low-carbon behaviour. The interplay between the internal and external factors of platform interaction mechanisms directly promotes public low-carbon actions. Philanthropic group identification—governed by group effects and emotional interaction—is an external intervening factor driving public low-carbon behaviour, influencing the sustainability of these actions. The psychological satisfaction effect—dictated by competitiveness, a sense of achievement, goal orientation, and an environmental mission sense—is an intrinsic context condition driving public low-carbon behaviour, influencing the intensity of individual low-carbon actions. Individual behavioural tendencies—determined by ingrained habits, behavioural preferences, and leisure time—drive the subsequent actions in public low-carbon behaviour, impacting its sustainability.

This study bears substantial theoretical and practical value. The theoretical value is principally manifested in the following aspects: (1) The study utilises related theories and knowledge from disciplines of communication, sociology, psychology, and management to probe into public low-carbon behaviour issues under the internet context, realising interdisciplinary cross-research and making attempts at integrative research across disciplines. (2) Most past low-carbon behaviour studies adhered to a deductive approach to validate the explanatory power of existing theoretical frameworks on current phenomena, or verify presupposed hypotheses. In contrast, this paper, without pre-establishing theoretical frameworks and hypotheses, follows an inductive research approach and constructs a new theoretical framework through grounded theory, contributing to the further enrichment of behavioural theory systems. The practical value primarily manifests in the following ways: (1) The study indicates that public environmental responsibility awareness can be influenced by external factors. Therefore, the government can fully utilise internet platforms for promotional activities, disseminate environmental knowledge to the public, and enhance public environmental responsibility awareness through external stimuli. (2) This study thoroughly explores the public's demand for participating in low-carbon behaviour. Therefore, policymakers can leverage platform feedback mechanisms to deeply understand the public's genuine needs in the policy formulation process, providing information support to refine relevant policies. (3) Platform operators should establish a long-term effective interactive mechanism, maintain the freshness of user experiences, and sustain public low-carbon behaviour. For instance, they can further perfect social interaction mechanisms to satisfy users' social needs. Overall, this study provides some reflections on building mechanisms for low-carbon behaviour that allow for the continued participation of the entire populace, with the hope of aiding sustainable ecological development.

This study also has certain limitations: (1) This research selected university students as interviewees, mainly considering that this group is the most active participant group in "Ant Forest." Their dynamic thinking, strong information reception capacity, and acute behavior perception capabilities could provide richer information for this study. However, this might lead to a lack of representativeness due to the singularity of interviewees. Although grounded theory does not pursue representativeness in the traditional sense—since its focus is not on statistical generality but on understanding and revealing phenomena, processes, or behaviors in specific contexts—the singularity of research subjects inevitably poses the risk of insufficient validity of obtained information. (2) The theoretical model constructed in this paper is proposed based on exploratory research. However, due to the space limitations of this paper, the effectiveness of this model has not yet been empirically tested. Therefore, conducting empirical testing of the model has become a future research entry point for this topic, using large-scale questionnaire surveys to verify the scientific nature of the model. (3) This paper uses "Ant Forest" as a case study, and the research conclusions obtained may have problems of insufficient generalizability. On one hand, this is caused by the inherent limitations of case studies. On the other hand, the current internet-based green public welfare platforms vary greatly in their heterogeneity. Each platform's driving mechanism is different, making it

challenging to cover all platforms through the "Ant Forest" case alone. Therefore, comparative research on different types of internet green public welfare platforms could serve as a focus for future studies.

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