

Imperceptible, Entertaining: The Impact of Gamification on Public Friendly Environmental Behavior

-- Take Ant Forest as an Example

Xiaoqiong Qiao, Zhenglin Zhang

School of Management, Xi'an Polytechnic University, Xi'an 710600, China

Abstract: Faced with growing pressure for environmental sustainability, many companies are exploring innovative ways to incorporate "green" practices into their day-to-day processes. The purpose of this study was to explore the impact mechanism of gamified empowerment mediated by environmental identity and user engagement on pro-environmental behaviors, and to conduct data analysis based on the questionnaires of 341 participants. The study found that: gamification has a positive impact on users' environmental identity and user fit; environmental identity and user fit can promote the generation and continuation of pro-environmental behavior; environmental identity and user fit play an intermediary role in individual pro-environmental behavior effect. The research enriches the related research on gamification and pro-environmental behavior, and provides suggestions for the development and design of green information systems.

Keywords: Friendly Environmental Behaviors; Gamification; Affordance; Environmental Cognition; Customer Engagement.

1. Introduction

In recent years, with the continuous promotion of slogans such as "green waters and green mountains are golden mountains and silver mountains" and "carbon peak, carbon neutrality", the construction of ecological civilization has deeply rooted in people's hearts. With the advancement of information technology and business models, protecting the environment is not only a manifestation of corporate social responsibility, but also one of the methods to build green enterprises, reduce production costs, improve corporate image and customer brand awareness, and gain more benefits for enterprises. As a direct stakeholder of environmental issues, enterprises have recognized the seriousness of the problem during their business development and have taken many environmental protection measures related to the environment. However, relying solely on corporate measures for environmental protection is not enough, and it requires the participation of every employee and even every citizen. The Guiding Opinions on Building a Modern Environmental Governance System issued by the Central Committee of the Communist Party of China and the General Office of the State Council in 2020 clearly highlighted the need to form an environmental management system with universal participation and improve environmental management efficiency by 2025. Therefore, it is particularly important to improve citizens' friendly environmental behavior.

The existing research on the influencing factors of public friendly environmental behavior mainly focuses on citizens' cognition, gender demographic characteristics, cultural factors, and social capital. However, there is relatively little research on the impact of gamification on public friendly environmental behavior. Gamification refers to the use of game design factors in non-game contexts. Among them, promoting people to use certain game mechanisms and related elements to adopt target behavior in non-game contexts is a typical feature of gamification, and its design has non

gamification, integrity, interactivity, and sustainability. Previous studies have pointed out that gamification and friendly environmental behavior have shown that gamification can promote citizens' environmental behavior by stimulating user pleasure (Mi L Y, et al.) and competitive preferences (Huang J L, Zhou L Y.). Other articles have shown that gamification can promote e-commerce users to adopt green consumption behavior. At present, the ant forest launched by Alipay is the most representative of the gamification and green consumption platform. Users can obtain "energy" by using green transportation methods. When the energy reaches a certain amount, they can choose to plant trees in the desert, ant forest, and real life, and also issue corresponding certificates to encourage users to continue green consumption. As of now, Ant Forest has over 550 million users and has planted over 200 million real trees in desertification areas, with a total planting area of over 3 million acres. Therefore, this study takes Ant Forest as an example to study how gamification will affect users' friendly environmental behavior, providing suggestions for enterprises to better design, develop, and operate green systems.

2. Theoretical Basis and Research Hypotheses

2.1. Environmentally Friendly Behavior

Environmentally friendly behavior refers to the environmentally friendly behavior that individuals exhibit in their daily lives, which has a positive impact on the environment and is closely related to the ecological environment. The scope of 'friendly environmental behavior' is very broad, including friendly environmental behaviors in daily life, such as garbage sorting and green transportation; There are friendly environmental behaviors in consumption, such as purchasing green products and using green packaging.

Most existing research focuses on studying friendly o

environmental behavior from individual perspectives such as demographic characteristics, social capital, and individual personality, as well as from the perspective of structural subjects such as the organizational cultural atmosphere and social networks in which individuals reside. However, in the context of the information age, through the effective utilization of green information systems, some enterprises have achieved outstanding results in environmental protection and achieved positive market returns; Some enterprises have significantly saved energy in production. While discovering that green information systems continuously create economic and environmental value, we also find that there is not much research on the application of green information systems for individuals. On the basis of analyzing and summarizing literature, this article will study the friendly environmental behavior of individuals in society when using green information systems, which is determined by their own interest orientation.

2.2. Gamification and It's Indicative Performance

Gamification "refers to the addition of game design factors in non-game contexts (Deterding S., et al), which refers to the use of game elements or game mechanisms to motivate users to achieve a certain goal. Gamification has been widely applied and achieved in various fields such as Taobao e-commerce's red envelope grabbing, intelligent AI, and inviting customers to participate in challenges and obtain discounts in restaurants. Game elements refer to the gameplay that users experience, the interaction between users and game scenarios, tools, etc., and the game design that creates a game experience. One of the important purposes of adopting gamified design is to increase user engagement in activities or related system operations through game element settings.

Table 1. Typical Gamification Performance

category	Indicator name	explain
human-computer interaction	Autonomous support indicator	The possibility of users making self-decisions, emphasizing the relationship between functionality and user needs
	Achievement Visualization Performance	Display users' phased achievements through progress bars and other methods to enhance their sense of competence for the activity
human-human interaction	Competitive energy display	The likelihood of users comparing their performance with others
	Interactive energy display	The possibility of users interacting with others to gain social relationships

Gamification performance refers to the likelihood that the game information system can meet the relevant needs of users in the game context. According to the interaction forms of human-machine systems, gamified display performance can be divided into gamified display performance for human-machine interaction and gamified display performance for human interaction (Liu D, Santhanam R). Gamification from the perspective of human-computer interaction refers to the gamification involved in the interaction between users and

information system interfaces, which generally focuses on the effects brought to users by the technical and information characteristics of human-computer interaction pages. Gamification from the perspective of interpersonal interaction refers to the gamification of communication between users through information systems, which generally focuses on the effects brought to users by the technical and information characteristics of human-computer interaction pages. This gamified display typically involves multiple users participating in the game and interacting with other users in the game. As shown in Table 1, gamification performance from the perspective of human-computer interaction includes autonomous support performance and achievement visualization performance; Gamification display from the perspective of human interaction includes competitive display and interactive display.

2.3. Gamification Manifestation and Environmentally Friendly Behavior

According to the theory of self-determination, people's behavior is mainly influenced by three motivations: internal, external, and internalization. The human-computer interaction demonstrated by gamification refers to the participants participating in the game in order to obtain satisfaction and sense of achievement from it. Users can obtain tree planting energy through green travel and other behaviors in the ant forest, and can freely choose which type of tree to plant and where to plant it, greatly satisfying their tree planting autonomy. In addition, Ant Forest will issue honorary certificates to users every time they plant a tree, enhancing their sense of green achievement. Behind each virtual number in Ant Forest is the user's repeated environmental behavior. Therefore, with the continuous improvement of human-machine interaction between users and Ant Forest, the connection between users and Ant Forest becomes closer, and games become more daily. In order to obtain energy, users will adopt more environmental behavior, thereby subtly improving their friendly environmental behavior.

The interpersonal interaction of Ant Forest is reflected in its integration of online and offline activities, where friends in Ant Forest generally get to know each other in their daily lives. Utilizing the emotions that Chinese people value, Ant Forest has developed characteristic trees of family, love, and friendship, allowing users to practice green behavior together with those around them, making contributions to the cause of green environmental protection. Secondly, based on the design of rankings and environmental protection certificates, users can view the environmental performance obtained by their friends, stimulating their competition in the virtual environment. Through competition, users can compare their performance with others, strive to surpass others' performance (Suh A., et al.), and immerse themselves more (Liu D, Santhanam R, Webster J). In order to surpass others, users will also engage in more pro-environmental behaviors to obtain green energy. Based on this, this article proposes the following assumptions:

H1a: Autonomous support for indicator performance can help improve users' friendly environmental behavior.

H1b: Visualization of achievements can help improve user friendly behavior.

H1c: Competitive performance can help improve users' friendly environmental behavior.

H1d: Interactive display performance helps improve user

friendly behavior.

2.4. The Mediating Role of Environmental Identity

From a psychological perspective, identification is a specific emotional connection. Environmental identity refers to a common belief that influences individuals to engage in environmental activities, closely linking organizations, groups, and individuals to create more green value together. Environmental identity is the embodiment of moral norms within an individual's body in the environment. At present, extensive research has been conducted on environmental identity from the perspective of organizational behavior or employee relationships. However, there is relatively little research on the mechanism of user generated and enhanced environmental identity in the use of green information systems. Therefore, this article studies environmental identity as a mediating variable from the perspective of green behavior and gamification of green information systems, analyzing the effect of gamification of green information systems on environmental identity and the way in which environmental identity affects friendly environmental behavior.

The self-determination theory regards meeting the psychological needs of user autonomy as one of the main factors that enhance user intrinsic motivation (Deci E L, Ryan R M). Autonomy means an individual's self-organizing experience and actions, manifested as the need for self-activity to be consistent with their sense of wholeness, and it mainly emphasizes a sense of control. Visualization has brought many positive experiences to users. In gamified scenarios, visualization is specifically reflected in the quantification and display of users' phased achievements and final results, greatly mobilizing users' enthusiasm for continuous participation. Visualization capability refers to the possibility for users to visualize their achievements through progress bars, data, tree planting numbers, leaderboards, and other information. In the process of using gamified green information systems, individuals are able to actively control the game progress and achieve phased results, achieving achievements in the system, thereby promoting users' sense of environmental identity and promoting their friendly environmental behavior. Due to the use of Ant Forest, users' awareness of environmental protection and environmental identity are constantly improving. In order to meet their potential environmental awareness needs, they will carry out corresponding environmental activities. Based on this, this article proposes the following assumptions:

H2a: In the process of users using gamified green information systems, environmental identity plays a mediating role in the autonomous support of indicator performance and individual friendly environmental behavior.

H2b: In the process of users using gamified green information systems, environmental identity plays a mediating role in achieving visual performance and individual friendly environmental behavior.

Competitiveness is one of the important components of games. The so-called competitive performance refers to the likelihood that users can compare their own performance with others. Under the influence of competitive psychology, users can feel a sense of superiority and strengthen social connections with others. So, by adding competitive elements, users can be more willing to participate in game activities and increase their willingness to continue participating in the

game process. In the process of using gamified green information systems, individuals are able to compare and compete with others, thereby promoting users' sense of environmental identity and strengthening their pro environmental behavior (Wang, X., et al.). In addition, users unconsciously engage in more friendly environmental activities in competition with others, and these activities also improve their environmental awareness to a certain extent, thereby enhancing users' friendly environmental behavior.

Seeking and establishing social relationships is an inherent characteristic of humanity. For this reason, some scholars suggest adding interactive elements (such as game dialogues, game-based interaction between people, etc.) to the design of gamified projects. Interactive display is the possibility for users to communicate and interact with other users. Research has shown that social relationships are also an important component of games. According to the user's sense of community connection, Whang, Hang, and others divide game users into individual oriented players, community-oriented players, and display evasion players (Whang L S M, Chang G.). Among them, community-oriented players attach great importance to the function of interacting with other users during the game process. Therefore, interactivity is an essential part of gamified information systems. In the process of using gamified green information systems, individuals are able to interact and establish social relationships with others. In the process of communicating with other users, they strengthen their environmental awareness and promote their friendly environmental behavior through the information and attitudes of others. Based on this, this article proposes the following assumptions:

H3a: In the process of users using gamified green information systems, environmental identity plays a mediating role in competitive display and individual friendly environmental behavior.

H3b: In the process of users using gamified green information systems, environmental identity plays a mediating role in interactive display and individual friendly environmental behavior.

2.5. The Mediating Role of User Fit

User fit is a psychological state that arises through the interaction with agents or objects in a service relationship to create a common customer experience. User fit, as a dynamic and iterative psychological state, exists in service relationships, creating value together between users and brands. VAN DOORN et al. define user fit as the behavior of a user towards a brand or company that has not been purchased, which is driven by motivational factors, including word-of-mouth activities, recommendations, customer interaction, blogs, writing comments, and other similar activities (VAN DOORN J., et al). Some scholars have also enriched the concept of user fit as "user stickiness" and "continuous communication and interaction between users and brands or enterprises". After summarizing the literature, user fit can be divided into the following dimensions, which together constitute a comprehensive understanding of user fit: enthusiasm, attention, immersive feelings, and interaction.

Many scholars believe that providing choices is an important means to meet users' autonomous needs. However, providing choices does not fully meet users' autonomous needs. Autonomous support indicator emphasizes the possibility of action provided by the system as a whole to users to meet autonomous needs, emphasizing the

relationship between functions and requirements. Therefore, starting from user autonomy needs and fully considering user satisfaction with the overall functionality of the system, it is possible to avoid overlooking the impact of some important technical features in meeting user requirements. Providing autonomous support to enhance users' awareness of the expressiveness of autonomous support can not only enhance their enthusiasm and satisfaction for participating in behavior (Robert L P, You S), but also maximize their contribution. However, when an individual's level of autonomy decreases, their perceived pleasure will also decrease, which will affect their future behavior. In other words, by improving the autonomy and support of users in the game, it can enhance the fit between users and the game, enhance the frequency of game usage, and thereby promote user friendly behavior.

In the process of using gamified green information systems, individuals are able to actively control the progress of the game and achieve phased results, achieving achievements in the system, satisfying users' "flaunting" social comparison, stimulating users' enjoyment and immersion in the game experience (Hamari J.), thereby enhancing user fit and promoting user friendly behavior. The more energy users collect during the process of using Ant Forest, the more achievements they achieve, which satisfies their sense of achievement and the satisfaction of freely operating games. This promotes closer interaction and communication with the product, improves user compatibility, and leads to more environmentally friendly behavior during the process of using Ant Forest. Based on this, this article proposes the following assumptions:

H4a: In the process of users using gamified green information systems, user fit plays a mediating role in the autonomous support of indicator performance and individual friendly environmental behavior.

H4b: In the process of users using gamified green information systems, user fit plays a mediating role in achieving visual performance and individual friendly environmental behavior.

Through competition, users can feel a sense of superiority and also feel the connection with other users. Therefore, by adding competitive elements, users can compare themselves socially with others. Competition will make users enjoy it, thereby enhancing user fit and increasing their willingness to continue participating in the game process. In the Ant Forest, the more competitors users face, the more willing they are to continuously pay attention to their performance in the Ant Forest, and improve their ranking in the Ant Forest through more efforts. This is to some extent a manifestation of user fit improvement, and in the process of striving to improve their performance, users also complete more pro-environmental behaviors.

Users tend to utilize game elements such as social interaction to achieve communication and interaction with others, and gamified information systems provide support for information exchange and transmission between users. The interaction provided by Ant Forest to users is different from traditional interaction methods. In Ant Forest, users can achieve their interaction goals through interesting ways such as "stealing energy from each other". Through these interesting ways, users can experience the interest in interacting with friends (Rogers R), thereby improving the fit between users and the game. In addition, through communication with other users, users can feel the joy of socializing, and exchanging information and sharing experiences with friends with similar interests and hobbies not only improves their user fit in the Ant Forest, but also increases their willingness to spend more time in the Ant Forest, leading to more environmentally friendly behaviors. Based on this, this article proposes the following assumptions:

H5a: In the process of users using gamified green information systems, user fit plays a mediating role in competitive display and individual friendly environmental behavior.

H5b: In the process of users using gamified green information systems, user fit plays a mediating role in interactive display and individual friendly environmental behavior.

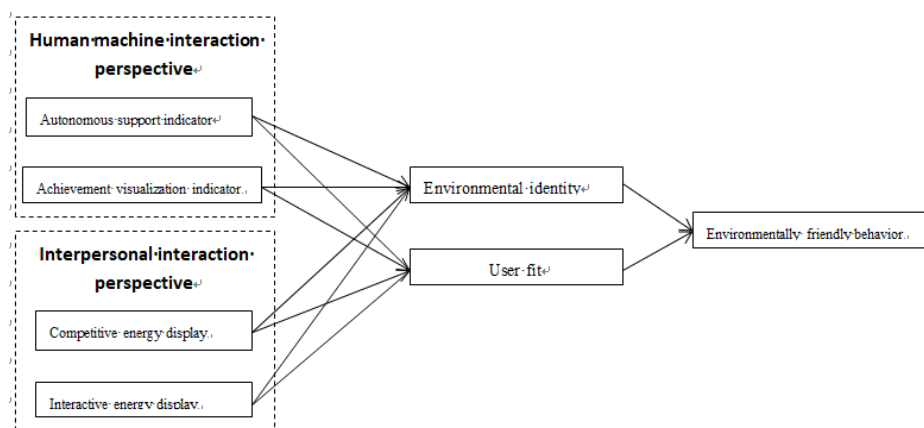


Figure 1. Theoretical Model

3. Research Method

3.1. Data Collection and Sample Description

The study used a questionnaire survey method. As this article mainly studies the impact of the use of gamified green information systems on people's pro environmental behavior, Ant Forest is the largest gamified green information system in China. Therefore, the survey population of this article is domestic Ant Forest users. The respondents are people aged

20 to 40 years old. These users use Alipay more frequently and are the main user group of Ant Forest. Their participation is high. The survey results can better reflect the impact of participation in the game based green information system on pro environmental behavior. According to statistics, a total of 341 valid questionnaires were collected. Among them, males account for 45.7% and females account for 54.3%; The age is mainly concentrated between 20 and 40 years old, accounting for 78.6%; In terms of education level, most of them have a

bachelor's degree, accounting for 54.8%.

3.2. Variable Measurement

The scale items used in this study are all from mature scales both domestically and internationally, and adjustments have been made to the research subjects based on the citations.

Independent variable: Autonomous support for indicator performance mainly refers to the measurement scale of Economics (Nikou S A, Economides A), with a total of 3 items, such as "Games have strong openness, and I have strong control over the ways to obtain green energy and the selection of tree species". The Cronbach's α value is 0.708. The visualization of achievement performance mainly refers to Sue and Wagner's measurement scale (Suh A, Wagner C), with a total of 3 items, such as "It makes my progress in environmental protection clearly visible (such as energy level, achievement progress)", and the Cronbach's α value is 0.834. The competitive display ability mainly refers to the measurement scales of Suh et al, Sue, and Wagner, with a total of 3 items, such as "It allows me to compare myself with others (such as green energy)", and the Cronbach's α value is 0.821. Interactive display ability mainly refers to the measurement scales of Nikou and Economics (Nikou S A), Blasco Arcas etc., with a total of 2 items, such as "It gives me more ways and opportunities to interact with friends (such as watering and leaving messages)", and the Cronbach's α value is 0.807.

Intermediary variable: Environmental identity mainly refers to the measurement scale of van der Werff et al, with a total of 3 items, such as "I am a person who cares about environmental issues", and the Cronbach's α value is 0.853. The user fit mainly refers to Kevin Kam Fung So's measurement scale, which includes five dimensions of self-awareness, enthusiasm, level of care, immersive feeling, and interactive experience. Self-cognition includes two items, and enthusiasm, level of care, immersive feeling, and interactive experience each contain three items, a total of 14 items, such as "I have a deep affection for the ant forest" and "I like to

interact with friends in the ant forest", The Cronbach's α value is 0.920.

Dependent variable: The friendly environmental behavior mainly refers to the measurement scale developed by Gong Wenjuan, with a total of 8 questions, such as "I am willing to share environmental knowledge with friends, classmates, and colleagues around me". The Cronbach's α value is 0.901.

Control variables: This article selects gender, age, education level, and average monthly household income as the control variables.

4. Data Analysis

4.1. Reliability and Validity Testing and Correlation Analysis

This study used SPSS 25.0 and Amos 24.0 to analyze the reliability and validity of the scale. Through analysis, it was found that the Cronbach α values of all variables were greater than 0.7, proving the reliability of the scale selected in this study. From Table 2, it can be seen that the mean variance variation of each variable is greater than 0.5, and the combined reliability CR is greater than 0.7, indicating that the aggregation reliability of the scale selected in this study is good. In addition, the correlation coefficients between the selected variable and other variables in this study are all smaller than the AVE square root of that variable, indicating good discriminant validity between the variables. According to the correlation analysis results, there is a certain correlation between each variable, and the VIF value is less than 3, indicating that there is no multicollinearity problem between the variables. According to the results of confirmatory factor analysis, $\chi^2/df=2.336$, less than 3; RMSEA=0.063, less than 0.08, IFI=0.922, TLI=0.911, CFI=0.922, all greater than 0.9, indicating that the overall fitting effect of the model is good. In addition, the VIF values are all less than 5, and there is no multicollinearity problem.

Table 2. Combination reliability, mean variance extraction, multicollinearity, and correlation coefficient

	CR	AVE	VIF	1	2	3	4	5	6	7
1. Autonomous support indicator	0.708	0.548	2.348	0.740						
2. Achievement Visualization Performance	0.838	0.634	2.512	0.716**	0.796					
3. Competitive energy display	0.827	0.615	1.951	0.490**	0.513**	0.784				
4. Interactive energy display	0.810	0.681	2.005	0.509**	0.499**	0.634**	0.825			
5. Environmental identity	0.860	0.672	2.357	0.639**	0.667**	0.507**	0.559**	0.820		
6. User fit	0.921	0.538	1.884	0.506**	0.525**	0.555**	0.55**	0.598**	0.733	
7. Environmentally friendly behavior	0.901	0.567		0.634**	0.665**	0.511**	0.583**	0.809**	0.614**	0.753

Note: "** *" represents a significant level of 0.01 in the double tailed test, "*" represents a significant level of 0.05, and "+" represents a significant level of 0.10, all of which are double tailed tests. The bold data on the diagonal is the square root of AVE.

4.2. Regression Result Analysis

Table 3 shows the regression analysis of the variables in the model. Model 1 shows the regression results of the control variable on the dependent variable, while Model 2 shows the regression results of the independent variable and the control variable on the dependent variable. From the results, it can be

seen that there is a significant positive correlation between autonomy support and friendly environmental behavior ($p<0.001$, $\beta= 0.230$), there is a significant positive correlation between achievement visualization performance and friendly environmental behavior ($p<0.001$, $\beta= 0.345$), there is a significant positive correlation between interactive display ability and friendly environmental behavior ($p<0.001$,

$\beta = 0.249$), competitive energy has no significant impact on friendly environmental behavior. Therefore, assuming that H1a, H1b, and H1d are verified, H1c is not valid. Model 6 incorporates environmental identity on the basis of Model 2, and the results show a positive correlation between autonomous support ergodicity and friendly environmental behavior ($p < 0.1$), $\beta = 0.084$), there was a significant positive correlation between achievement visualization performance and friendly environmental behavior ($p < 0.01$), $\beta = 0.143$), there is a significant positive correlation between interactive display ability and friendly environmental behavior ($p < 0.01$, $\beta = 0.136$), compared to Model 1, although the variables are significant, their significance decreases, thus environmental identity plays a partial mediating role. Therefore, it is assumed that H2a, H2b, and H3b have been validated. Competitive performance has no significant impact on

friendly environmental behavior, and H3a is not valid. Model 7 added user fit on top of Model 2, and the results showed a positive correlation between autonomous support indicator performance and friendly environmental behavior ($p < 0.001$), $\beta = 0.192$), there is a significant positive correlation between achievement visualization performance and friendly environmental behavior ($p < 0.001$, $\beta = 0.288$), there is a significant positive correlation between interactive display ability and friendly environmental behavior ($p < 0.001$, $\beta = 0.204$), compared to Model 1, although the variables are significant, the coefficients decrease, thus user fit plays a partial mediating role. Therefore, it is assumed that H4a, H4b, and H5b have been validated. Competitive performance has no significant impact on friendly environmental behavior, and H5a is not valid.

Table 3. Linear Regression Results

variable	Environmentally friendly behavior			Environmental identity	User fit	Environmentally friendly behavior	
	model 1	model 2	model 3	model 4	model 5	model 6	model 7
Autonomous support indicator		0.230***		0.254***	0.143*	0.084 ⁺	0.192***
Achievement Visualization Performance		0.345***		0.351***	0.215***	0.143**	0.288***
Competitive energy display		0.056		0.062	0.200***	0.021	0.003
Interactive energy display		0.249***		0.196***	0.170**	0.136**	0.204***
Environmental identity			0.686***			0.575***	
User fit			0.225***				0.266***
gender	0.048	0.014	0.023	-0.008	0.013	0.019	0.011
age	0.001	0.005	-0.039	0.05	0.042	-0.025	-0.007
education	-0.033	-0.027	-0.005	-0.018	-0.058	-0.017	-0.012
monthly income	0.161**	0.023	-0.038	0.042	0.228***	-0.001	-0.038
F Value	2.538*	51.777***	121.049***	50.936***	40.356***	87.327***	53.125***
R ²	0.029	0.555	0.385	0.551	0.493	0.704	0.591
AdjustedR ²	0.018	0.544	0.679	0.540	0.481	0.696	0.580

Note: Adding "***" represents $p < 0.001$, "**" represents $p < 0.01$, "*" represents $p < 0.05$

To further validate the mediating effect, Hayes' Bootstrapping method was used for testing. Due to the insignificant competitive energy effect, no further validation was conducted. The Bootstrapping analysis results are shown in Table 3. From Table 3, it can be seen that the indirect effect value of environmental identity on friendly environmental behavior is 0.336, with a 95% confidence interval of [0.263, 0.419], excluding 0. The indirect effect value of user fit is 0.075, with a 95% confidence interval of [0.065, 0.206], excluding 0. It can be seen that the mediating effect between environmental identity and user fit is significant. Assuming H2a and H2b hold. In the pathway of the effect of achievement visualization on friendly environmental behavior, the indirect effect value of environmental identity is 0.350, with a 95% confidence interval of [0.274, 0.438], excluding 0. The indirect effect value of user fit is 0.081, with a 95% confidence interval of [0.042, 0.127], excluding 0. It can be seen that the mediating effect between environmental identity and user fit is significant, assuming H3a and H3b are valid. In the pathway of interaction manifestation on friendly environmental behavior, the indirect effect value of environmental identity is 0.286, with a 95% confidence interval of [0.215, 0.373], excluding 0. The indirect effect

value of user fit is 0.071, with a 95% confidence interval of [0.035, 0.114], excluding 0. It can be seen that the mediating effect between environmental identity and user fit is significant. Assuming that H5a and H5b are valid. By comparing the relative effect values, it can be found that environmental identity plays a greater mediating role in the influence of gamification on friendly environmental behavior than the mediating effect of user fit.

5. Conclusion

5.1. Research Conclusion

This study found that in gamified green information systems, gamified performance has a positive impact on user environmental identity and user fit. Due to the gamification of green information systems, it can bring positive feelings to users, subtly affecting their sense of environmental identity, and improving the compatibility between products and users through these pleasant feelings.

In green information systems, increasing the degree of freedom of games to enhance user autonomy support, improving the achievement system in the system, and enhancing user interaction may be more conducive to

building user environmental identity and improving the degree of fit between users and products, increasing user stickiness, and promoting users to engage in more pro-environmental activities through gamified green information systems. In the process of competing with other users, users cannot acquire knowledge related to environmental protection, nor can they communicate with others about environmental protection. In the competition process, users only focus on data and performance, and do not trigger further thinking and exploration behind the game. Therefore, competitive performance does not enhance users' friendly environmental behavior.

Both environmental identity and user fit will to some extent promote the development and generation of user-friendly environmental behavior, that is, users have a high sense of environmental identity or use gamified green information systems with high stickiness, which will lead to more friendly environmental behavior.

5.2. Research Significance

The wide application of Alipay Ant Forest has created many green values. This study analyzes the impact of gamification on environmental identity and user fit from the perspective of gamification, and analyzes the role of environmental identity and user fit in the impact of gamification on friendly environmental behavior. It also explains the mechanism path of ant forest promoting its green value realization.

From a corporate perspective, companies can achieve their green value and social responsibility by completing friendly environmental activities through their employees' personal behavior. Adopting gamified green information systems is a cost-effective and effective approach. Gamification of green information systems is not only beneficial for improving employees' environmental identity when using the system, but also encourages employees to take on personal social obligations, create social value, discover fun in the process of creating value, and enhance interaction and communication with others. Gamification of green information systems can ultimately achieve a win-win situation for individuals, businesses, and society.

Gamification performance can promote user friendly behavior by enhancing user engagement. Previous studies have shown that user engagement is beneficial for enhancing the connection between users and the platform, deepening users' love for the platform, and improving customer loyalty and willingness to continue using the platform. Therefore, green information system developers can promote the fit between users and the game by enhancing their autonomy, achievement visualization, and interaction in the game, and strengthen the connection between users and the game system.

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