



## Research article

# The moderating effect of environmental gamification on the relationship between social media marketing and consumer-brand engagement: A case study of Ant Forest Gen Z users

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## ABSTRACT

Social media marketing plays a relevant role in the brand promotion of enterprises owing to its advantages of rapid and diversified communication with consumers. The Chinese Internet enterprise Alipay launched Ant Forest as a mobile application with gamified social functions, bringing consumer-brand engagement. Ant Forest provides a variety of gamification functions (e. g. point, leaderboard, badge, task and teamwork) to encourage users to participate in environmental protection and public welfare activities. These gamification mechanisms, combined with the spread of social media, have realised the co-creation of user brand value. In the current study, 305 Gen Z users of Ant Forest were surveyed through an online questionnaire, and the data analysis was conducted using the partial least squares structural equation modelling (PLS-SEM) method. This study indicates that the four elements of entertainment, trendiness, customisation and word-of-mouth in social media marketing have statistically significant direct effects on the consumer-brand engagement in Ant Forest. In addition, gamification shows a significant positive moderating effect on the relationship between customisation and consumer-brand engagement and a significant negative moderating effect on the relationship between trendiness and consumer-brand engagement in Ant Forest. This study adds gamification to the conceptual system of social media marketing and provides suggestions for the development of gamified social media marketing applications.

## 1. Introduction

### 1.1. Social media marketing

As another type of marketing medium, social media can efficiently share brand intentions [1]. Over the past decade, enterprises have used social media to communicate with customers through diverse, complex and intensive interactions [2]. On the one hand, enterprises take advantage of social media to continuously expand the scope of services to customers in space [3] and increase customer-based brand equity through social media communication and interactive marketing [4]. On the other hand, customers are increasingly empowered by social media and engage in marketing communication, and they are shaped by social media as creators,

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disseminators and reviewers of information [5]. Therefore, marketers can increase consumer-brand engagement by adding fashionable and popular content to social media to enhance the marketing effect on social media [6]. In addition, the coronavirus disease (COVID-19) epidemic in recent years has led to more young consumers relying considerably on social media for communication and consumption [7].

### 1.2. Consumer-brand engagement

Currently, brands can interact with customers not only through their own communication but also through the communication of other consumers [8]. Such an environment has raised consumers' suspicion and resistance to traditional commercial media, and strengthening consumer engagement is the main countermeasure to deal with this situation [8]. Therefore, as a powerful strategic technique, inviting customers to engage in interaction with service providers can positively affect customer loyalty [9] and enhance enterprises' brand equity [10] to gain a competitive advantage in the market [11].

### 1.3. Gamification in social media marketing

In recent years, 'gamification' has gradually gained the attention of researchers because of the addition of systematic game elements to services [12]. The researchers found that the experiential and service marketing theories of games and gamification are highly compatible in being value creators together [12]. From the perspective of social marketing, gamification has been proven to affect consumers' motivation and behaviour, and this behavioural influence can be maintained for a period under the reasonable planning of gamification [13]. However, the effect of gamification on internal motivation has not yet been reported, and the internal mechanism of how to change behaviour results through gamification requires further research [13].

Under the context of fierce global competition, attracting new customers and maintaining old customers to purchase their own services and products have become relevant challenges for modern enterprises, especially for the marketers of these enterprises [14]. Therefore, these marketers started to favour innovative digital marketing techniques, and gamification with reward mechanisms and avatar customisation is often used in social media [14]. Moreover, previous studies by Cheung et al. [6], Bilal et al. [1] and Samarah et al. [8] pointed out the direct effect of social media marketing on consumer-brand engagement, none of which involved influences other than market factors. Therefore, this study will focus on the possible effects of gamification.

### 1.4. Ant Forest as social media in China

As a representative of emerging markets, China has the largest number of young gamers, and the expansion of gamification in marketing services has become a phenomenon worthy of attention in China [15]. Large technology enterprises in China (e.g. Xiaomi and Huawei) manage consumer-brand communities by building online gamified communities in marketing to promote brand engagement and brand loyalty [12]. Ant Forest is one of these gamified communities, which can encourage users to use their spare time to participate in environmental protection actions and cultivate their green awareness and habits [16]. Users of Ant Forest can use the mobile platform to record their low-carbon behaviours, obtain gamification rewards to cultivate their own virtual saplings and redeem the opportunity to plant real trees in the desert when the saplings grow up [16].

As a gamification-based social media application, entertainment, social, altruistic and environmental values in Ant Forest have a positive impact on consumers' attitudes towards continuous use of the application [17]. In addition, the intention of continuing to use applications will further affect consumers' intentions to implement pro-environmental behaviours [17]. Using the green benefits provided to consumers, Ant Forest has developed a persuasion system that combines gamification and social media functions [16]. Alibaba, the parent company of Ant Forest, is one of the most successful financial technology companies in China and has used Ant Forest's pro-environmental innovations to provide itself with a good reputation at home and abroad [18]. Therefore, users of Ant Forest are more willing to use applications related to Ant Forest and use them for pro-environmental consumption [18].

### 1.5. Generation Z (Gen Z) in social media marketing

Individuals born between 1996 and 2014 are generally referred to as Gen Z by the researchers, and the most relevant characteristic of this generation is that they grew up in an environment dominated by digital technology [19]. Gen Z grew up surrounded by various digital products, making them generally highly dependent users of social media and gamification applications [19]. Concurrently, Gen Z has become the largest and most challenging consumer group for marketers [20].

Growing up exposed to online phenomena such as privacy scandals, product recalls and fake news, Gen Z groups have a hard time trusting corporate brands and public images [19]. However, college students, as outstanding representatives of Gen Z consumers, are extremely concerned about brand image and brand meaning in marketing [21]. Therefore, the most relevant countermeasure is to actively build trust with them [19]. On social media, peers, friends, celebrities and opinion leaders have a significant impact on Gen Z consumption, which reflects the positive role of social interaction and the trend guidance of social networks [22]. Previous studies have also shown that entertainment, trendiness, interaction and word-of-mouth, the four main characteristics of social media marketing, have a huge impact on Gen Z consumption behaviour [20].

Gen Z accounts for 20% of China's total population, and their expenditure accounts for 13% of household expenditure, which is considerably higher than other countries (4% in the US and 3% in the UK) [23]. China's Gen Z has grown up with the rapid development of the digital age and social media as a result of rapid material abundance [23]. Data show that >70% of Gen Z tend to consume

through social media in China [24]. The Chinese government attaches great importance to the guidance of Gen Z's green consumption behaviour through subjective norms and social media [25]. Ling et al. [25] showed that subjective norms, perceived behavioural control, environmental knowledge and social media can strongly influence the green consumption behaviour of Gen Z in China. Especially after experiencing the impact of the COVID-19 pandemic, social media has become the most relevant way for Chinese students to receive education and obtain information and knowledge [26]. Because Gen Z users lack life experience and information processing ability, they are more likely to be influenced by external factors in social media than older adults [27]. In addition, a specific case study on the perception and purchase intention of wearable healthcare products shows that Gen Z in Hong Kong, China, is highly influenced by innovation information and word-of-mouth recommendations provided by social media [28]. Therefore, it is worthwhile for researchers to investigate the consumption behaviour of Gen Z from the perspective of social media marketing.

In summary, the research objectives of this study are.

1. How do the various elements of social media marketing affect the relationship between consumer-brand engagement of Chinese Gen Z in Ant Forest?
2. In the aforementioned relationship, what moderating role does gamification play?

## 2. Conceptual foundation and hypotheses development

### 2.1. Conceptual foundation

Cheung et al. [6] first proposed a complete conceptual framework in which social media marketing affects consumer-brand engagement. In this framework, the researchers decomposed social media marketing into five elements: entertainment, interaction, trendiness, customisation, and electronic word-of-mouth, and quantitatively surveyed their direct relationship with consumer-brand engagement [6]. Since then, the studies of Ebrahim [29], Bilal et al. [1], Wijayaa et al. [30], Rimadiaz et al. [31], and Samarah et al. [8] have continuously provided arguments and case studies for the conceptual framework and obtained similar results. Cheung et al. [32] continued to improve the application scenarios of the theory in their own follow-up research and added more variables for discussion. Therefore, this study also explores the role of gamification in the influence process based on the conceptual framework of social media marketing affecting consumer-brand engagement.

### 2.2. Social media marketing

Social media marketing is a concept that integrates multiple functions and disciplines [33]. It specifically refers to the creation of value for stakeholders through social media (which can also be combined with other communication channels) to achieve organisational objectives [33]. Social media marketing can not only affect consumers' brand awareness and the enterprise's brand image but also consumers' loyalty to the brand and their willingness to finally purchase the brand's products [34]. In addition, the use of social media has a great impact on investigating product quality and service quality, as well as customer perceived value [35]. Considering the aforementioned functions of social media marketing, it has become a relevant topic for enterprises to use social media to establish the connection between their own brand and consumers [36,37].

### 2.3. Consumer-brand engagement

Consumer-brand engagement is defined as 'consumers' brand-related cognitive, emotional, and behavioural activity related to focal brand interactions' (pp. 106) [38]. Consumer-brand engagement is reflected in consumers' cognition, emotion, and behaviour of brands [28]. Cognitive engagement refers to consumers' interest in and attention to brands, which is the embodiment of consumers' identification and understanding of brands [39]. Emotional engagement refers to the positive attitudes generated by consumers after interacting with brands, such as love, happiness, and pride [40]. Behavioural engagement refers to consumers investing time and energy in communicating and interacting with brands [41]. Overall, consumer-brand engagement reflects the intention of consumers to spend time and energy to recognise the brand, which is considered to be a relevant indicator to evaluate the effect of brand-consumer connection [41]. According to the aforementioned elements contained in social media marketing and the conceptual foundation of consumer-brand engagement, the following will discuss the concepts of these elements cited in this research and the hypotheses formed with the consumer-brand engagement of Ant Forest users.

### 2.4. Entertainment

Entertainment includes the needs of individuals for recreation, escapism, emotional and aesthetic enjoyment, and the ability to fulfil these needs [42]. The entertainment element in social media marketing refers to providing carriers and channels for users to enjoy and play through social media [43]. Previous studies have shown that entertainment on social media is an emerging concept for online content producers, where online communities, intermediaries, traditional media, and new media interact and coordinate with each other on a global scale [44]. In order to build an emotional connection between brands and consumers through social media, marketers include marketing materials in entertainment content to promote consumers' continuous intention to use social media [45]. In addition, online news media has a positive impact on consumer-brand engagement by enhancing entertainment and establishing communication channels with consumers [46]. Therefore, the following hypothesis can be proposed.

**H1.** Entertainment in social media marketing positively influences consumer-brand engagement in Ant Forest.

## 2.5. Interaction

In the context of social media marketing, interaction refers to providing opportunities for enterprises and users to share information and exchange opinions through social media platforms [47]. Consumers use social media and cyberspace to interact and communicate, express their views on brands, and engage in brand-related behaviours [48]. This one-to-one interaction between consumers and brands can have lower customer retention costs than traditional media such as TV, radio, newspapers, books, and magazines [49]. In the process of using social media to establish communication and maintain contact with customers, enterprises must choose the right marketing content to stabilise these relationships and achieve sustainable performance growth [50]. At the same time, the interaction function can motivate consumers to create user-generated content, which can also strengthen their brand recognition and purchase desire [51]. Therefore, the following hypothesis can be proposed.

**H2.** Interaction in social media marketing positively influences consumer-brand engagement in Ant Forest.

## 2.6. Trendiness

Trendiness in social media marketing refers to posting the latest information on a service or product through social media to lead fashion [52]. Enterprises not only need to publish the latest information, but also need constant updates, and the more information enterprises release, the better the effect of attracting consumers [53]. At the same time, consumers who use social media also want to see fashion brand products leading the latest trends and maintaining popular styles [54]. Enterprises also strengthen consumers' recognition of their own brand fashion through social media updates and sharing [40]. Trendiness is improving the quality of social media information to achieve the purpose of encouraging consumers to achieve value co-creation with the brand community [54]. In the study using big data to investigate the social media marketing of luxury brands, the trendiness dimension of the fifteen most popular brands on the Twitter platform showed an impact on customer engagement [36]. Therefore, the following hypothesis can be proposed.

**H3.** Trendiness in social media marketing positively influences consumer-brand engagement in Ant Forest.

## 2.7. Customisation

Customisation in social media marketing represents the provision of personalised customisation and information search functions through social media [52]. Customisation puts more emphasis on direct interaction with specific consumers to meet their specific needs in the social media environment, which is different from traditional marketing [55]. The emotional attachment to the brand will lead to the positive impact of mass customisation on brand loyalty [56]. Personalised digital marketing engines have played a huge role in e-commerce [57]. They can customise corresponding marketing strategies according to the different needs of users and provide users with commodity information through social media platforms, which makes the consumption performance of enterprises grow rapidly [57]. In addition, personalised advertising customised specifically for consumers in social commerce activities can encourage consumers' purchasing impulses [58]. Through the services aforementioned, the enterprise and brand are more likely to become the main choices in the decision-making process of consumers [59]. Therefore, the following hypothesis can be proposed.

**H4.** Customisation in social media marketing positively influences consumer-brand engagement in Ant Forest.

## 2.8. Word-of-mouth

Word-of-mouth in social media marketing refers to a social media comment system that is engaged and guided by consumers [60]. Word-of-mouth encompasses the characteristics of consumers using social media to exchange, disseminate, and upload information [31]. In a case study of Tiktok, the social media marketing platform in the Indonesian tourism sector, word-of-mouth was shown to positively influence brand engagement among consumers [31]. As online consumers increasingly rely on word-of-mouth in their purchasing decisions, traditional advertising has undergone major changes in the context of rapidly changing social media in recent years [61]. This decision-making process spreads rapidly among consumers, both known and unknown to each other [61]. Positive word-of-mouth will enhance consumers' loyalty to the brands and their willingness to buy products from these brands [31]. Therefore, the following hypothesis can be proposed.

**H5.** Word-of-mouth in social media marketing positively influences consumer-brand engagement in Ant Forest.

## 2.9. Gamification

The significance of this study is to consider the moderating effect of gamification in the case of Ant Forest. Therefore, the following part will focus on the conceptual foundation and indirect effect of gamification in this study, and then propose hypotheses. Gamification refers to the provision of motivation by evoking a gaming experience, which ultimately enhances services and achieves further behavioural outcomes [12]. Relying on interaction design and sustainability, gamification has gradually gained attention and achieved success in the field of marketing services [62]. Its main goal is to allow consumers to participate in game interaction in a non-game

context [62]. In social media marketing, gamification has proven to be an effective tool for building sustainable value through human interaction [63]. Applying gamification elements in non-gamification digital environments has been shown to greatly influence the decisions of online consumers [63].

Enterprises use gamification systems in their operations to drive consumer motivation for brand engagement and experience, thereby influencing users' co-creation of brand value [64]. A case study of consumer engagement in crowdsourcing campaigns also demonstrates the effectiveness of gamification elements in promoting continued user engagement [65]. Another case study shows that gamification can provide consumers with challenges, fun, and social interaction to awaken their positive emotions and thus increase brand stickiness through mobile applications [66]. In addition, gamification interaction plays a relevant role in promoting consumer loyalty, purchase intention, and word-of-mouth sharing behaviour [67]. The use of gamification in e-commerce platforms has also been shown to have a critical impact on enterprise reputation and user repurchase intentions [68].

According to the literature reviews, the researchers put forward the indirect moderating hypotheses of this study as follows.

**H6.** Gamification moderates the relationship between entertainment and consumer-brand engagement in Ant Forest.

**H7.** Gamification moderates the relationship between interaction and consumer-brand engagement in Ant Forest.

**H8.** Gamification moderates the relationship between trendiness and consumer-brand engagement in Ant Forest.

**H9.** Gamification moderates the relationship between customisation and consumer-brand engagement in Ant Forest.

**H10.** Gamification moderates the relationship between word-of-mouth and consumer-brand engagement in Ant Forest.

In summary, a conceptual framework was proposed with the direct and indirect hypotheses aforementioned (see Fig. 1).

### 3. Methodology

#### 3.1. Survey design

Overall, this study used the quantitative survey research method to obtain objective research conclusions by collecting and analysing responses from participants [69]. The researchers of this study obtained feedback from a large number of participants through an online questionnaire and used partial least squares structural equation modelling (PLS-SEM) to analyse the data to obtain the research results [70]. This quantitative survey process included five parts: questionnaire collection, data verification, structural correlation, effect display, and predictive analysis.

In order to test the results of the hypotheses, this study adopted a convenience sampling method to collect survey data using an online questionnaire platform. Participants are limited to Gen Z consumers who have used Ant Forest. Ant Forest has more than 500 million users in China [71]. Faced with such a large and common sampling population, convenience research can obtain effective results [72]. Considering that primary and secondary schools in China have time restrictions for minors to use mobile phones to play games, the subjects of this survey are also required to be adults (over 18 years old).

The online questionnaire platform used in this survey is Wenjuanxin, the largest online survey tool in China [73]. The questionnaire was distributed through online chat tools and social media platforms. Participants participated in the questionnaire voluntarily and

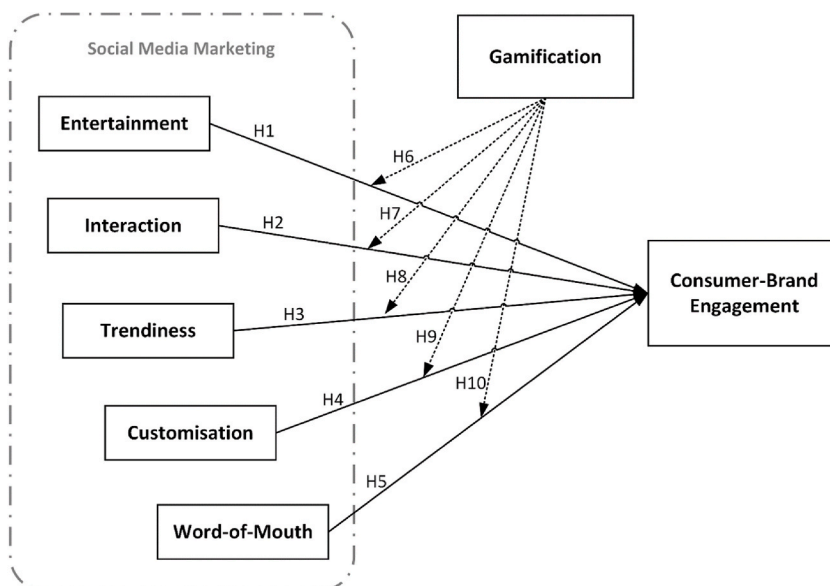


Fig. 1. Conceptual framework of this study.

were told that they could stop answering the questionnaire at any time [74]. It took about 10–15 min to complete the questionnaire. At the beginning of the questionnaire, the researcher stated the purpose of the study, the rights of the participants, and set screening questions to ensure that the age range of the participants (18–27 years old), the experience of using Ant Forest and obtaining gamified reward as feedback.

### 3.2. Measures

According to the research objectives, the survey questionnaire is designed to detect the relationship among the variables in the conceptual framework. The questionnaire has two main components, which are the demographic information of the participants and the attitudes of the participants toward the variable-related questions. The demographic information part includes an understanding of the participants' age, gender, education, occupation, income, and the basic usage of Ant Forest. The variable-related questions are divided into seven parts corresponding to seven variables in the framework, which were all developed by previous researchers (see Appendix 1). All constructs related to the variable survey used the 'five-point Likert scale' (1 = strongly disagree, 5 = strongly agree). These constructs have been reviewed by three professors and professionals to ensure the appropriateness and validity of the content and passed a pilot test involving 50 university students before being officially used. All constructs showed acceptable reliability in pilot tests (Cronbach's alpha >0.70). The data from the pilot test was not included in the final results.

In this survey, 305 valid questionnaires were finally collected after eliminating invalid data. The questionnaire does not collect the names and contact information of the participants, and only presents them centrally in the form of data to ensure research ethics [75]. Demographic profile of respondents is shown in Appendix 2. Due to Gen Z and age restrictions over 18 years old, most of the participants were college students (n = 246), accounting for 80.66% of the total number of participants. Women accounted for the majority (62.3%) of the respondents. The respondents included in the statistical data are all Ant Forest users, and the respondents who chose not to use Ant Forest in the questionnaire have been excluded to ensure that the survey data can meet the requirements of the

**Table 1**  
The Assessment results in measurement model.

Constructs	Items	Loadings	Cronbach's alpha	CR	AVE
Entertainment (EN)	EN1	0.933	0.932	0.934	0.833
	EN2	0.913			
	EN3	0.943			
	EN4	0.860			
Interaction (IN)	IN1	0.928	0.949	0.965	0.866
	IN2	0.947			
	IN3	0.931			
	IN4	0.917			
Trendiness (TR)	TR1	0.897	0.854	0.886	0.772
	TR2	0.859			
	TR3	0.879			
Customisation (CU)	CU1	0.969	0.956	0.957	0.853
	CU2	0.915			
	CU3	0.941			
	CU4	0.843			
	CU5	0.944			
Word-of-Mouth (WM)	WM1	0.925	0.888	0.888	0.819
	WM2	0.846			
	WM3	0.940			
Consumer-Brand Engagement (CE)	CE1	0.886	0.973	0.974	0.808
	CE2	0.839			
	CE3	0.886			
	CE4	0.899			
	CE5	0.921			
	CE6	0.926			
	CE7	0.846			
	CE8	0.928			
	CE9	0.927			
	CE10	0.927			
Gamification (GA)	GA1	0.803	0.941	0.944	0.652
	GA2	0.781			
	GA3	0.822			
	GA4	0.808			
	GA5	0.810			
	GA6	0.825			
	GA7	0.802			
	GA8	0.805			
	GA9	0.805			
	GA10	0.816			

Note: CR = Composite Reliability, AVE = Average Variance Extracted.

research objectives.

## 4. Results

### 4.1. Measurement model

The study data were analysed using Smart-PLS 4.0 software to evaluate measurements and structural models. Cronbach's alpha and composite reliability (CR) are calculated in the measurement model to detect the reliability of the model, while factor loadings and average variance extracted (AVE) are also calculated to reflect the convergence effectiveness of the model (see Table 1). All the factor loading values are greater than 0.7, and the AVE values are greater than 0.6, which indicates that all items in the questionnaire show high reliability [76]. Table 1 also shows that Cronbach's alpha of all constructs is maintained between 0.854 and 0.973, and CR is maintained between 0.886 and 0.974, which means that all constructs maintain internal consistency and discriminant validity [77].

Fornell & Larcker criterion and Heterotrait-Monotrait Ratio (HTMT) are two common methods used to assess the discriminant validity of survey constructs [78]. Table 2 shows that the square root of the AVE of each construct is at the highest value compared to other potential constructs in the Fornell-Larcker Criterion [79]. Meanwhile, Table 3 shows that all scales have values less than 0.9 in the HTMT [80]. Therefore, the discriminant validity of the survey data has passed the double authentication of the Fornell-Larcker Criterion and HTMT.

### 4.2. Structural model

This study used the bootstrapping resampling function in SmartPLS software to calculate the relationship between variables in the conceptual framework to get the results of the structural model (see Table 4). Among all the direct effects, entertainment (H1), trendiness (H3), customisation (H4) and word-of-mouth (H5) in social media marketing show significant positive effects on consumer-brand engagement, because these *p*-values of hypotheses are all less than 0.05 [70]. Among the established hypotheses, customisation has the most significant effect on consumer-brand engagement, which can be judged from the difference in  $\beta$  values ( $\beta = 0.238$ ). The index ( $f^2$ ) to detect the effect size also shows the same result, that is, the effect size of customisation on consumer-brand engagement is the highest ( $f^2 = 0.039$ ) [70], and it can be identified as the effect of large size [81].

In the test of the indirect effect, gamification showed moderating effects on the relationships between trendiness, customisation and consumer-brand engagement (*p*-values <0.05) [70]. Among them, gamification showed a negative moderation ( $\beta = -0.145$ ) to the relationship between trendiness and consumer-brand engagement, while it showed a positive moderation ( $\beta = 0.135$ ) to the relationship between customisation and consumer-brand engagement. Judging by the  $f^2$  value, the negative moderating effect of gamification on trendiness is large, and the positive moderating effect on customisation is medium [81].

Previous researchers pointed out that only using the path coefficient to detect the effect of moderating variables is incomplete, and it is necessary to consider using latent variables to estimate the interaction to provide more evidence [82]. The simple slope analysis parameter of Smart-PLS software can support this argument (see Figs. 2 and 3).

Fig. 2 shows that as the SD value of gamification increases, the slope of the effect of customisation on consumer-brand engagement gradually increases. It is evident that the moderating effect of gamification is gradually enhanced; that is, the better the implementation of gamification in Ant Forest, the stronger the impact of customisation on the consumer-brand engagement of users. Fig. 3 shows that as the SD value of gamification increases, the slope of the effect of trendiness on consumer-brand engagement gradually decreases. It is evident that the moderating effect of gamification is gradually weakened; that is, the better the implementation of gamification in Ant Forest, the weaker the impact of trendiness on consumer-brand engagement.

Finally, in order to ensure the rigour of the results, the researchers tested the stability of the research framework. The results in Fig. 4 show that the R2 value of the dependent variable in the research framework is close to 0.75, which can be judged as substantial [70]. At the same time, the Q2 results shown in Table 5 are all greater than zero, indicating that both exogenous and endogenous constructs in the research framework have predictive relevance [70].

## 5. Discussions

According to the results of quantitative research, the four elements of entertainment, trendiness, customisation and word-of-mouth in social media marketing have been proven to have statistically significant direct influences on the consumer-brand engagement of

**Table 2**  
Discriminant validity (Fornell-Larcker criterion).

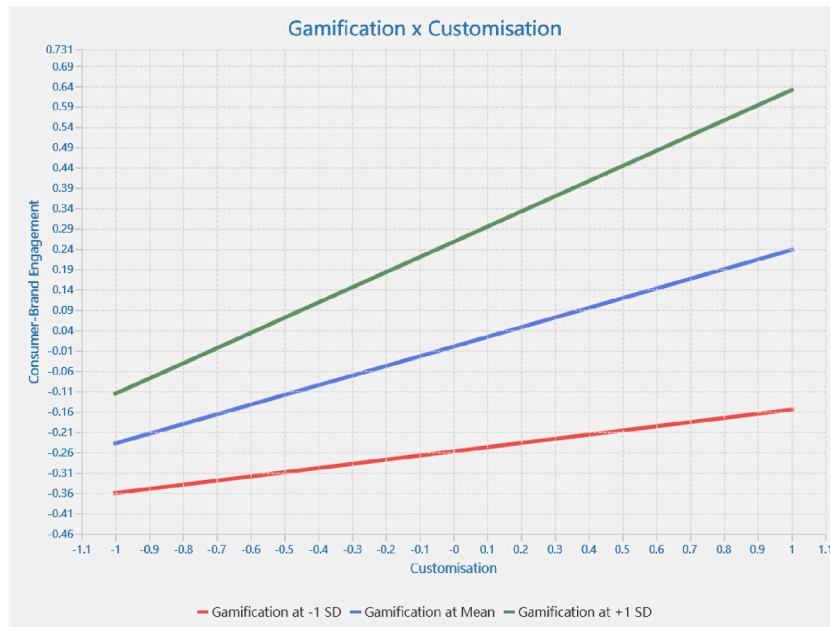
		1	2	3	4	5	6	7
1.	Entertainment	<b>0.912</b>						
2.	Interaction	0.431	<b>0.931</b>					
3.	Trendiness	0.444	0.801	<b>0.878</b>				
4.	Customisation	0.815	0.502	0.509	<b>0.923</b>			
5.	Word-of-Mouth	0.683	0.407	0.415	0.803	<b>0.905</b>		
6.	Consumer-Brand Engagement	0.747	0.571	0.584	0.791	0.693	<b>0.899</b>	
7.	Gamification	0.741	0.440	0.440	0.732	0.632	0.734	<b>0.808</b>

**Table 3**  
Discriminant validity (HTMT criterion).

		1	2	3	4	5	6	7
1.	Entertainment							
2.	Interaction	0.449						
3.	Trendiness	0.485	0.894					
4.	Customisation	0.863	0.516	0.552				
5.	Word-of-Mouth	0.750	0.434	0.466	0.871			
6.	Consumer-Brand Engagement	0.783	0.583	0.625	0.819	0.745		
7.	Gamification	0.789	0.453	0.470	0.766	0.687	0.758	

**Table 4**  
Survey results of hypotheses.

Hypotheses/Relationships		Std. beta ( $\beta$ )	Std. dev	t-value	p-value	$f^2$	Decision
H1	Entertainment - > Consumer-Brand Engagement	0.177	0.068	2.613	0.009	0.034	Accept
H2	Interaction - > Consumer-Brand Engagement	0.087	0.048	1.784	0.074	0.009	Reject
H3	Trendiness - > Consumer-Brand Engagement	0.152	0.046	3.299	0.001	0.031	Accept
H4	Customisation - > Consumer-Brand Engagement	0.238	0.077	3.082	0.002	0.039	Accept
H5	Word-of-Mouth - > Consumer-Brand Engagement	0.110	0.055	2.008	0.045	0.016	Accept
H6	Gamification x Entertainment - > Consumer-Brand Engagement	0.014	0.059	0.241	0.809	0.000	Reject
H7	Gamification x Interaction - > Consumer-Brand Engagement	0.055	0.048	1.158	0.247	0.003	Reject
H8	Gamification x Trendiness - > Consumer-Brand Engagement	-0.145	0.050	2.868	0.004	0.026	Accept
H9	Gamification x Customisation - > Consumer-Brand Engagement	0.135	0.064	2.105	0.035	0.015	Accept
H10	Gamification x Word-of-Mouth - > Consumer-Brand Engagement	-0.078	0.045	1.716	0.086	0.010	Reject



**Fig. 2.** Moderating test of customisation in simple slope analysis.

Ant Forest users. The aforementioned results are highly consistent with previous research results on social media marketing and consumer-brand engagement [1,6,8]. It is evident that consumers have the same recognition for the brand engagement created by Ant Forest as the consumption scenarios provided by other enterprises. Contrary to common cognition, interaction in social media marketing and consumer-brand engagement are relatively rare and do not show a significant direct correlation in Ant Forest. Many previous studies, including the researchers' own survey, found that almost all Ant Forest users would select chat tools provided by other enterprises (e.g. WeChat and QQ) when conducting social interactions [83–87]. Therefore, the chances of users using Ant Forest's own brand chat tool for interaction are extremely small.

Previous research has shown that users' stereotyped influence on applications makes them unwilling to replace the instant messaging features commonly used in social media, even though these features can achieve the same social interaction effect in



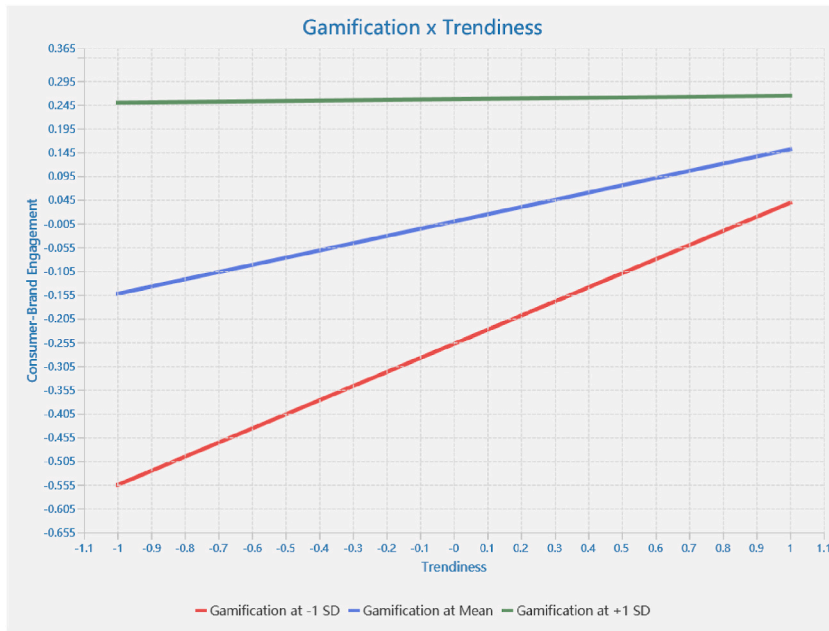


Fig. 3. Moderating test of trendiness in simple slope analysis.

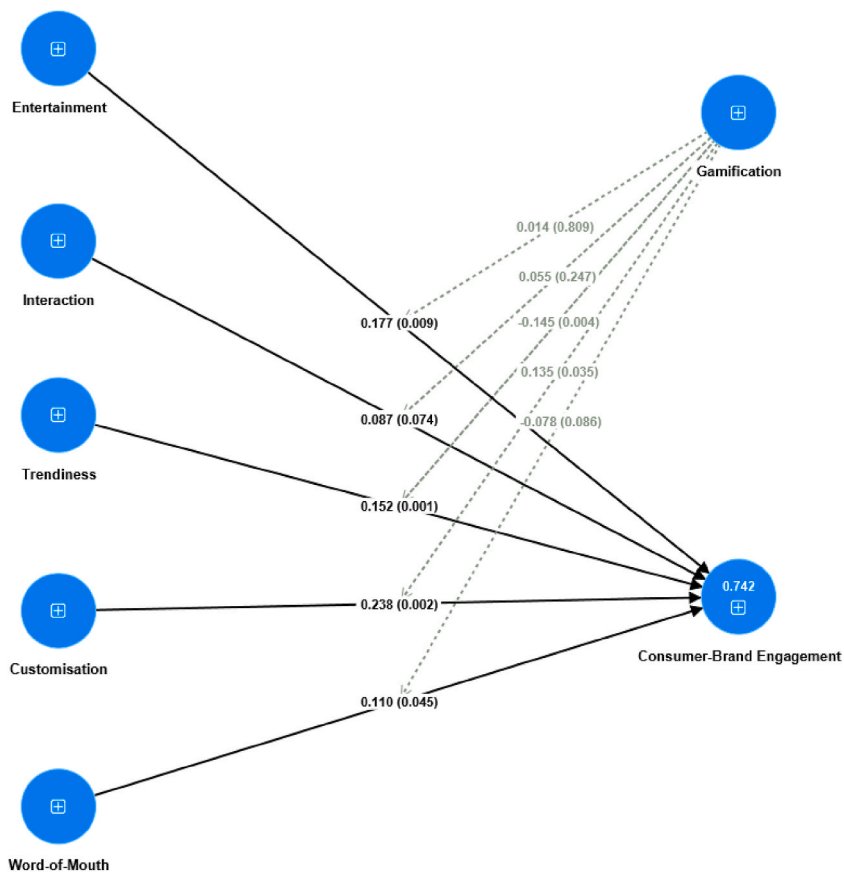


Fig. 4. Structural Model (With Path coefficients, p-value and R<sup>2</sup>).

**Table 5**  
Result of Q<sup>2</sup>.

Constructs	Q <sup>2</sup>
Entertainment	0.701
Interaction	0.753
Trendiness	0.516
Customisation	0.768
Word-of-Mouth	0.601
Gamification	0.571
Consumer-Brand Engagement	0.762

different applications [88]. In the application where Ant Forest is located, users also selected the social function provided by competing enterprises, resulting in the neglect of its own instant messaging function [88]. In the research on the electronic payment of Alipay, where Ant Forest is located, the researchers also found similar issues [89–91]. Therefore, the researchers of this study believe that the inability to provide a good instant interactive experience belonging to their own brand is a relevant reason why the parent enterprise of Ant Forest cannot strengthen the consumer-brand engagement of Ant Forest users through interaction.

In the study of the indirect effect of gamification as a moderator variable, gamification showed a significant positive effect on the relationship between customisation and consumer-brand engagement in Ant Forest. The customisation function brought by the gamification system can provide consumers with a platform to enhance customer-brand relationships and engagement [92]. Xi and Hamari [12] also concluded that customisation, classified as an immersive element in gamification, has a positive impact on consumer-brand engagement. Therefore, gamification in Ant Forest has been proven to stimulate the effect of customisation elements in social media marketing on consumer-brand engagement. The stimulating effect of gamification was judged to be medium, and from the results of simple slope analysis, the greater the stimulus was, the better the effect was.

In addition, gamification showed a significant negative moderating effect on the relationship between trendiness and consumer-brand engagement in Ant Forest. While gamified platforms have proven more appealing to novelty-seeking consumers, this finding does not apply to all consumers [93], since most users select Ant Forest because it is considered to be an inevitable trend through which they can really engage in environmental protection in a realistic way [94]. In addition, this popular trend runs counter to the massive virtual rewards provided by gamification in Ant Forest [95]. Therefore, the researchers have reason to believe that, as a young Gen Z group, too much pursuit of a virtual gamified experience will reduce the influence of trendiness elements in social media marketing on consumer-brand engagement in Ant Forest. Its reducing effect was judged to be large, and from the results of simple slope analysis, this effect will gradually weaken until it becomes negligible with the enhancement of this gamification experience.

In addition, gamification does not constitute a moderating effect on the relationship between other elements in social media marketing (entertainment, interaction and word-of-mouth) and consumer-brand engagement. Although gamification is an extremely attractive function for Ant Forest users [95], the three aspects of entertainment, interaction and word-of-mouth provided by social media marketing have not played effective incentive roles in the process of consumer-brand engagement. In particular, as relevant components of gamification [96], the influences of entertainment and interaction on consumer-brand engagement have not been strengthened by the gamification of Ant Forest, which is contrary to previous research [97]. Ant Forest requires further improvement in its gamification design as a social media platform that relies on gamification to attract users.

## 6. Conclusions

### 6.1. Theoretical significance

This study verified the applicability of the theory that social marketing affects consumer-brand engagement proposed by Cheung et al. [6] in the social media application Ant Forest and introduced gamification as a moderating variable into the research framework for the first time. This study examined the effect of gamification on five common elements of social media marketing and explored the value of gamification in the theoretical research of social media marketing. Social media marketing theory has a positive effect on online user brand value co-creation, and gamification can play a relevant role as a catalyst to stimulate enterprises' social responsibility and physical business operations [64].

### 6.2. Practical significance

This study explores the marketing role of gamification design in a massive social media application and analyses the process of gamification affecting customisation and trendiness in social media marketing, which is helpful for the development of similar social media applications. In addition, the researchers pointed out the reasons why interaction and trendiness in gamified social media marketing have a poor impact on consumer-brand engagement in the specific case of Ant Forest, which is helpful for the improvement of Ant Forest's functions.

### 6.3. Limitations and future directions

The main limitation of this study stems from the incomplete sampling of potential participants. Because the research subject has a

large number of online users and it is difficult to count a complete research population, this study used convenient sampling and mainly limited the research scope to the age range of Gen Z. Future researchers can refine the sampling method to obtain more representative results. In addition, as the core experience of gamification, the entertainment and interaction of Ant Forest are not affected by the moderation of gamification. Further research should be conducted on the reason for this phenomenon.

### Ethics declarations

- This study was reviewed and approved by Jawatankuasa Etika Penyelidikan Manusia Universiti Sains Malaysia (JEPeM-USM), with the approval number: USM/JEPeM/22090640.
- All participants provided informed consent to participate in the study.

### CRedit authorship contribution statement

**Miao Huang:** Writing – review & editing, Writing – original draft, Software, Resources, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Mohamad Saifudin Mohamad Saleh:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Izzal Asnira Zolkepli:** Writing – review & editing, Validation, Supervision.

### Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests. Miao Huang reports financial support was provided by Jiangsu Provincial Department of Education. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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### Appendix 1 Summary of Construct Items and Sources

Construct	Code	Questionnaire Items	Source
Entertainment (EN)	EN1	The Ant Forest content found in Alipay social media seems interesting.	[6]
	EN2	It is exciting to use Alipay's social media.	
	EN3	It is fun to collect Ant Forest information on products through Alipay's social media.	
	EN4	It is easy to kill time using Alipay's social media.	
Interaction (IN)	IN1	It is easy to convey my opinion through Alipay's social media.	
	IN2	It is easy to convey my opinions or conversation with other Ant Forest users through Alipay's social media.	
	IN3	It is possible to have two-way interaction through Alipay's social media.	
	IN4	It is possible to share Ant Forest information with other users through Alipay's social media.	
Trendiness (TR)	TR1	Content found on Alipay's social media are up to date	
	TR2	Using Alipay's social media is very trendy.	
	TR3	The content on Alipay's social media is the newest Ant Forest information.	
Customisation (CU)	CU1	It is possible to search for customised Ant Forest information on Alipay's social media.	
	CU2	Alipay's social media provide customised Ant Forest services.	
	CU3	Alipay's social media provide lively feed Ant Forest information I am interested in.	
	CU4	It is easy to use Alipay's social media.	
	CU5	Alipay's social media can be used anytime, anywhere.	
Word-of-Mouth (WM)	WM1	I would like to pass Ant Forest information on brands, products or services from Alipay's social media to my friends.	
	WM2	I would like to upload Ant Forest content from Alipay's social media on my Wechat or Weibo.	
	WM3	I would like to share opinions on Ant Forest brands, items or services acquired from Alipay's social media with my friends.	
Consumer-Brand Engagement (CE)	CE1	Using Ant Forest get me to think about Alipay.	
	CE2	I think about Alipay a lot when I am using Ant Forest.	
	CE3	Using Ant Forest stimulates my interest to learn more about Alipay.	
	CE4	I feel very positive when I use Alipay.	
	CE5	Using Alipay makes me happy.	
	CE6	I feel good when I use Alipay.	
	CE7	I am proud to use Alipay.	
	CE8	I spend a lot of time using Alipay compared with applications of other brands.	

(continued on next page)

(continued)

Construct	Code	Questionnaire Items	Source
Gamification (GA)	CE9	Whenever I am using smartphones, I usually use Alipay.	[98]
	CE10	I use Alipay the most.	
	GA1	Ant Forest is easy to use on the Alipay platform.	
	GA2	I feel more motivated to be more sustainable after using Ant Forest.	
	GA3	I feel motivated to know previous sustainable activities after using the Ant Forest.	
	GA4	The levels of Ant Forest motivate me to practice sustainable activities even more.	
	GA5	Ant Forest turns my sustainable activities funnier.	
	GA6	Ant Forest facilitates the navigation on the Alipay platform well.	
	GA7	After using Ant Forest, I have more interest in sustainable activities that I am not interested before.	
	GA8	Ant Forest helps me to develop my daily sustainable activities.	
GA9	Receiving medals in Ant Forest is one more reason to motivate me to practice sustainable activities.		
GA10	I am happy and proud for my friends acquiring their medals.		

## Appendix 2. Demographic Profile of Respondents

		Total (n = 305)	
		Frequency	Percentage
Age	18	34	11.2
	19	104	34.1
	20	86	28.2
	21	11	3.6
	22	26	8.5
	23	13	4.3
	24	16	5.3
	25	15	4.9
Gender	Male	115	37.7
	Female	190	62.3
Education	Undergraduate	229	75.1
	Postgraduate	76	24.9
Occupation	Public official	3	1.0
	Professional technician	21	6.9
	Researcher	28	9.2
	Freelancers	7	2.3
	Student	246	80.7
Monthly Income	Below 4000 (CNY)	159	52.1
	4000-6000 (CNY)	23	7.5
	6001-10000 (CNY)	28	9.2
	10001-16000 (CNY)	7	2.3
Ant Forest Usage Duration	Refuse to answer	88	28.9
	Below one month	91	29.8
	One month – Five months	75	24.6
	Six months – One year	34	11.2
Ant Forest Usage Frequency	Above one year	105	34.4
	Every few days	201	65.9
	Once per day	81	26.6
Achievement in Ant Forest	Several times per day	23	7.5
	Collected 'green energy' but Completed no planting	243	79.7
	Completed one planting	53	17.4
How to know Ant Forest	Complete more than plantings	9	3.0
	Recommended in Alipay App	221	72.5
	Recommended by friend	37	12.1
	Advertising in other ways	15	4.9
	Others	32	10.5

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