

Do network externalities and perceived gratifications boost WeChat continued use? Combining perspectives of network externalities and uses and gratifications

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ABSTRACT

Rapid burgeoning of mobile social media has become the primary channel by which individuals construct interpersonal networks and contact with each other recently. The primary objectives of this study are to explore how and whether network externalities would enhance WeChat users' distinct types of perceived gratifications, and how such perception of gratifications subsequently impacts their attitudes and continuous usage behavior. This article utilized a structured web-based survey questionnaire to conduct empirical research, and gathered and analyzed data of 788 WeChat users by structural equation modeling (SEM) approach. Perceived gratifications are categorized into three dimensions: hedonic gratifications, social gratifications, and utilitarian gratifications. Obtained outcomes reveal that both referent network size and perceived complementarity are positively and significantly associated with all three dimensions of perceived gratifications. Additionally, hedonic gratifications, social gratifications, and utilitarian gratifications are positively related to users' attitudes toward WeChat, which, in turn, are significantly correlated with their continuous usage behavior. These findings contribute to the growing body of literature on WeChat user behavior, offering novel theoretical insights for academics and practical implications for mobile social media operators.

1. Introduction

Mobile Social Networking Sites (SNSs) have rapidly integrated into the dynamics of daily communication, serving as pivotal platforms for extensive digital interaction (Apaolaza et al., 2019; Lai & Chong, 2021; Xuan et al., 2024; Yang et al., 2022). These platforms, including prominent examples like Facebook, LinkedIn, and WeChat, have not only redefined interpersonal communication but also facilitated the formation of expansive virtual communities. While mobile SNSs are often broadly categorized as web-based applications that revolutionize communication via digital cooperation, their impact extends significantly beyond mere connectivity (Lin & Lu, 2011; Pang et al., 2024; Yang & Lin, 2022). The operational models of mobile SNSs, characterized by their innovative approaches to user engagement and content dissemination, have garnered significant attention from both

practitioners and academics, illustrating a paradigm shift in how digital interactions are perceived and valued (Lin & Lu, 2011; Singh et al., 2023; Wang et al., 2022).

The widespread adoption of these platforms can be attributed to network externalities where the perceived value of the SNS increases as more individuals join the network. This phenomenon is particularly evident in the exponential growth of WeChat, which boasts over 1.24 billion monthly active users and accounts for a significant portion of data traffic among Chinese mobile users as of late 2021 (Cao et al., 2024; Cong et al., 2022; Singh et al., 2023). Launched in 2011 by Tencent, WeChat has transcended its initial messaging functionality to become a comprehensive platform enabling multifaceted social interactions at minimal cost to users (Chen et al., 2018; Liu et al., 2020; Yang et al., 2022). Through features that facilitate text, voice, and video communication, as well as the sharing of photos, videos, and location data,

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WeChat exemplifies the sophisticated utility of modern SNSs in fostering community building and information exchange (Liu et al., 2018; Pang, 2022; Singh et al., 2023; Xuan et al., 2024).

The rapid proliferation and user engagement on mobile SNSs can be comprehensively understood through the lenses of network externalities and the Uses and Gratifications Theory (UGT). Network externalities highlight the increased utility and appeal of SNSs as more users engage with the platform, thereby enhancing the value derived by each user (Chen et al., 2018; Wang et al., 2022; Zhang et al., 2017). Concurrently, UGT provides a framework for analyzing how individuals actively select media sources that meet their various emotional and cognitive need (Lai & Chong, 2021; Singh et al., 2023). This dual-theoretical approach not only deepens the understanding of why SNSs have become indispensable in modern communication but also underscores this study's theoretical contribution by linking these dynamics to the specific gratifications obtained from SNS usage (Chen et al., 2018; Pang & Zhang, 2024; Wang et al., 2022).

Researchers have established that network externalities significantly shape user behavior on social media platforms, serving as a pivotal driver for engagement (Lin & Lu, 2011; Phua et al., 2017; Wang et al., 2022). However, the existing body of research has largely overlooked a critical aspect: how these network externalities influence individuals' perceptions of mobile social media. This represents a critical gap in the literature, as understanding how these externalities influence cognitive processes related to perception is essential for comprehending broader user behavior in mobile SNS environments. Moreover, given that mobile SNS platforms rely heavily on user interaction and engagement, the role of users is central to the sustained success of these platforms (Cao et al., 2024; Chen et al., 2018; Shaikh et al., 2015). Yet, the identification of effective strategies to retain current users and strengthen their continuance decisions remains underexplored. Developing such strategies is crucial for ensuring ongoing user commitment and the long-term success of technology platforms. While prior studies have examined user behavior in adopting information technology through the lens of the uses and gratifications theory (Apaolaza et al., 2019; Singh et al., 2023; Wang et al., 2022), these studies primarily focus on the internal and external motivations that drive user behavior, noting that perceived gratifications arise from various motivational factors. However, the connection between network externalities and these individual gratifications has not been thoroughly investigated. Specifically, the impact of network externalities such as the increasing value of a platform with the growth of its user base on user satisfaction and continuance intentions remains largely unexplored (Lai & Chong, 2021; Liu et al., 2018; Pang et al., 2024). Consequently, it is imperative to delve into the relationship between network externalities and individual gratifications to elucidate the underlying dynamics of users' attitudes and their continuous usage behavior.

This research endeavors to theoretically construct and empirically validate a comprehensive study model. The article methodically investigates the intricate relationships among network externalities, perceived gratifications, WeChat users' attitudes, and their continued usage behavior. Drawing on the theoretical frameworks of network externalities and Uses and Gratifications (U&G) theory, this study articulates a set of hypotheses and a conceptual model from a psychosocial perspective. Given the rapidly evolving landscape of social media platforms, user retention remains a critical factor for the long-term success of any digital platform. By investigating the continuance intention of young users, this study aims to elucidate the underlying motivations and factors associated with their likelihood of continuing to use WeChat in the future. The research also elucidates the reasons behind the sustained adoption of WeChat by individuals in today's media-saturated environments. This study contributes to the theoretical understanding of mobile SNSs by bridging the gap between network externalities and uses and gratifications theory. It offers a nuanced exploration of how these platforms satisfy user needs while simultaneously expanding their user base through the network effects. By doing so, the research provides

insights into the mechanisms that drive the sustained growth and influence of mobile SNSs. Furthermore, the findings from this study are poised to offer valuable insights to mobile social media providers, enabling them to enhance the quality of their services or products and bolster their competitive edge in the market.

2. Theoretical basis and hypotheses construction

2.1. The impact of referent network size on perceived gratifications

Network externalities are conceptualized as the enhancement and improvement of utility and effects that users derive from the consumption of products or services, which are contingent upon the increasing participation of other agents and the production of a variety of supplementary goods and services (Yang & Lin, 2022; Zhang et al., 2017). Added benefits of the technology use arising from network externalities are considered as network effects while the goods that display such effects are identified as network products (Pang & Ruan, 2023; Rietveld & Ploog, 2021; Xu et al., 2018). Mobile SNS as the most popular and fashionable communication technologies, generally demonstrate powerful network effects (Chen et al., 2018; Coe & Yang, 2022; Shaikh et al., 2015). According to prior studies, network externalities primarily encompass two types: direct and indirect (Chang, 2018; Sarkar & Khare, 2019; Wang et al., 2022). Direct network externalities arise from factors that generate network effects due to the expansion of network size, such as the increasing number of consumers participating in the production of specific goods (Liu et al., 2020; Singh et al., 2023).

With different fresh users engage in the products or services, existing users could easily exchange useful information and establish rich social interactions with more potential users, and acquire increasing utility and benefits consequently (Chang, 2018; Yang et al., 2022). Moreover, participants can obtain more knowledge and social support through more facilitating conditions. Therefore, most scholars generally adopt network size which is recognized as the sum number of users in some specific online products to represent direct externalities (Chang, 2018; Jung et al., 2021; Mouakket & Sun, 2019). By contrast, indirect externalities are reckoned as additional increased benefits derived from the development of complementary functions and services offered by others on the basis of increasing users' population (Zhang et al., 2017). Thus, numerous researchers generally consider perceived complementarity as a critical component of indirect externalities (Li & Fang, 2019; Onyina et al., 2022; Zhao & Lu, 2012). The improvement of user's effectiveness is not only derived from the total number of people, but arise with the increase of compatible and complementary goods or items. When more complementary products are provided, consumers may possess more opportunities to obtain benefits and utility via different channels. Moreover, the higher level of complementary services, the more surplus values bring to users (Broekhuizen et al., 2021). Previous studies have demonstrated that the direct and indirect network externalities also could be applied to mobile social media (Gao & Bai, 2014; Sarkar & Khare, 2019; Yang & Lin, 2022).

Uses and gratifications (U&G) theory was regarded as an infusive theoretical framework based on a user-centered view developed in the academic field of communication and psychology over the past few decades (Chang, 2018; Gan, 2017; Shang et al., 2017; Singh et al., 2023). Building on the foundational principles of the U&G theory, it is posited that users engage with different media platforms to satisfy diverse gratification needs, thereby shaping their unique patterns of media consumption (Singh et al., 2023; Yang et al., 2022). U&G theory has been extensively investigated within the realms of traditional media, including broadcast (Shin, 2008) and magazine (Kim et al., 2015), underscoring the notion that individuals selectively use media sources to fulfill specific psychological needs and motivations (Marino et al., 2017). This selective media usage is driven by users' personal motivations, which not only dictate the choice of media but also influence the manner and intensity of use. Consequently, the understanding of these

varying user motivations is critical for elucidating the differential patterns of media engagement among individuals.

With the growth of mobile technology and mobile services, internet gradually replaces traditional media in communication process (Hou et al., 2020; Lyu, et al., 2024; Pang & Ruan, 2023). An increasing number of studies have applied the U&G theory to new media environments, aiming to further elucidate the psychological motivations underlying the use of mobile social media (Gan, 2017; Ibáñez-Sánchez et al., 2022; Kaur et al., 2020; Lyu, et al., 2024). For instance, some scholars believed consumers who possess a higher level of entertainment, information, and sociality motivation are more willing to use social media (Cong et al., 2022; Zhang et al., 2017). Recent studies have identified that users' motivations for social media usage can be categorized into three distinct aspects: hedonic motivation, social gratifications, and utilitarian gratifications (Flecha-Ortiz et al., 2023; Gan, 2017). Additionally, Singh, et al. summarized three dimensions to identify values consisting of seeking advice value, convenience value and information value (Singh et al., 2023). Building upon the foundational insights of previous research, as well as U&G theory, this paper proposes a classification of the perceived gratifications associated with WeChat usage into three principal dimensions: hedonic gratifications, social gratifications, and utilitarian gratifications.

Several studies have explicitly demonstrated that direct and indirect network externalities significantly enhance users' perceived gratifications from media engagement (Chang, 2018; Cheng, 2020; Wei & Lu, 2014). A key feature of mobile social media is its capacity to expand interpersonal relationships as user adoption grows, leading to more frequent interactions and greater enjoyment and social gratifications (Chen et al., 2021; Zhang, et al., 2024). Recent research further indicates that a larger referent network strengthens social interactivity and emotional gratifications (Wei & Lu, 2014). Several research suggests that the size of the referent network can also influence perceived social interactivity by strengthening connections with others (Alam et al., 2024; Cao et al., 2024; Mouakket & Sun, 2019). Moreover, perceived complementarity has been linked to higher perceived gratifications, with studies showing that high complementarity positively affects hedonic and emotional gratifications (Cheng, 2020). There was also a study highlighting that high perception of complementarity positively affect hedonic and emotional gratifications as a variety of mobile social apps adoption (Zhang et al., 2017). Although prior literature has explored the impact of direct and indirect network externalities on users' perceived gratifications (Li et al., 2018; Lyu, et al., 2024), it remains unclear whether these externalities influence the various dimensions of perceived gratifications to the same extent. Thus, this study aims to systematically explore the relationships between network externalities and perceived gratifications, positing the following hypotheses:

H1. Referent network size will positively predict hedonic gratifications.

H2. Referent network size will positively predict social gratifications.

H3. Referent network size will positively predict utilitarian gratifications.

H4. Perceived complementarity will positively predict hedonic gratifications.

H5. Perceived complementarity will positively predict social gratifications.

H6. Perceived complementarity will positively predict utilitarian gratifications.

2.2. The impact of perceived gratifications on attitudes toward WeChat

Empirical evidence from extensive studies on usage motivation and perceived value consistently demonstrates that these varied gratifications significantly influence individuals' attitudes toward different

mobile social media applications (Alhassan et al., 2020; Gan, 2017; Lin, 2014; Xuan et al., 2024). The first dimension of perceived gratifications concerns hedonic gratifications. Liu et al. defined these as the perceived emotional arousal or the fulfillment of cognitive expectations related to internet use (Liu et al., 2020). Within the realm of social media, hedonic gratifications typically reflect the emotional states of users, such as their attitudes toward an application or service. An insightful study conducted by Gan revealed that individuals with a more positive attitude are more inclined to use WeChat to satisfy their hedonic needs (Gan, 2017). Similarly, Ha et al. demonstrated that hedonic gratifications significantly influence users' acceptance of mobile social media platforms (Ha et al., 2015). The second dimension pertains to social gratifications, which involve the establishment and maintenance of social relationships and the fulfillment of social needs (Cheng & Jiang, 2020; Cong et al., 2022).

Research on WeChat users suggested that perceived social motivations significantly shape users' attitudes toward the platform (Li & Shang, 2020). Consistently, Zadeh, et al. explored the antecedents of attitudes toward social media marketing messages and found that personal integrative and social gratifications positively impact attitudes toward social media (Zadeh, et al., 2023). The third dimension, utilitarian gratifications, evaluates how users perceive the usefulness of information within a social networking environment. Utilitarian gratifications are defined as the extent to which individuals gather and perceive useful and beneficial information within a social networking environment (Gan, 2017; Singh et al., 2023). Plentiful number of existing research showed that users perceive more convenience of acquiring vital information via social media as an growing popular channel, they may have the positive performance such as a positive attitude and satisfaction (Cheshin et al., 2018; Pang, 2021; Wang et al., 2022). Furthermore, U&G theory supports the finding that users who perceive a higher level of utilitarian gratifications are more likely to manifest a positive attitude toward mobile services (Alam et al., 2024; Wang et al., 2021; Yang et al., 2022). Based on these insights, the following hypotheses are posited:

H7. Hedonic gratifications will positively predict attitudes toward WeChat.

H8. Social gratifications will positively predict attitudes toward WeChat.

H9. Utilitarian gratifications will positively predict attitudes toward WeChat.

2.3. The impact of attitudes toward WeChat on continuous usage behavior

Attitudes refer to the kind of affective evaluation and reflection toward the specific product or service and it is considered as the determinant of behavioral intention which exerts a key influence on continuous usage behavior (Cho et al., 2019; Flecha-Ortiz et al., 2023; McLean et al., 2020; Naneva et al., 2020). According to the attitude-behavior theory, individuals' attitudes and behaviors mutually influence each other, demonstrating a consistent relationship (Han et al., 2019; Sheeran et al., 2016). Users are prone to produce a particular behavior to better fulfill their inner demands and positive attitude factors motivate individuals to portray specific continuous behaviors along the original route (Chang, 2018). Thus, it is always reasonable that individual owning higher level of attitudes toward social media performs more favorable usage behaviors.

As attitude-behavior theory reputed that attitudes toward online good and service generally resulted in future intention, it has gained broadly attention in the field of online services usage (Cheah et al., 2022; Kasilingam, 2020; Teo et al., 2019). A great number of studies have demonstrated the positive impact of attitudes toward social media on behavioral intention and actual continuous usage behaviors (Chiang,

2013; Lim & Kim, 2020; McLean et al., 2020). For instance, Chiang discovered that affective attitudes toward online social platform have an important effect on the continuous usage intention and behavior (Chiang, 2013). Subsequently, Oghuma et al. drawing on expectation-confirmation theory, investigated the key factors influencing users' continuance intentions and found that user satisfaction significantly predicted the intention to continue using mobile instant messaging (Oghuma et al., 2016). Recently, there is a study showed that positive attitudes toward mobile social applications would lead to brand loyalty and continued purchase intention for product (McLean et al., 2020). Additionally, Lim and Kim also provide strong evidence for the affective factors which play a significant role in shopping behaviors such as continuous intention, e-loyalty (Lim & Kim, 2020). Thus, the research hypothesizes:

H10. Attitudes toward WeChat will positively predict continuous usage behavior.

3. Study and measurements

3.1. Conceptual research model

This conceptual study model mainly is composed of the antecedents of WeChat continuous usage behavior including network externalities, perceived gratifications, attitudes, and the investigation of whether individuals' different dimensions of perceived gratifications affect their attitudes toward WeChat. Additionally, the research model probes the possible relationship between attitudes toward WeChat and continuous usage behaviors as well. Furthermore, the study hypothesizes that perceived gratifications and attitudes serve as essential mediators within the conceptual framework linking the independent variables to the dependent outcomes. Following the theoretical exposition, the study methodically operationalizes these constructs and empirically assesses the indirect effects hypothesized within these mediating pathways. Fig. 1 illustrates this conceptual model used in this study, which represents the hypothetical associations among the scaled constructs.

3.2. Research sample

Previous research has highlighted that young adults represent a critical customer segment, particularly influential in the early adoption of new products or services through their extensive use of online social networks (Pang et al., 2024; Yang et al., 2022). Tjahja and Potjomkina further emphasize that this demographic plays a pivotal role in driving the growth of the Internet economy (Tjahja & Potjomkina, 2024). Moreover, younger generations are not only the predominant users of

platforms like WeChat but also demonstrate higher engagement levels in various WeChat-related activities compared to other age groups (Apaolaza et al., 2019; Pang & Zhang, 2024; Singh et al., 2023). Given that 73 % of mobile SNS users in China fall within the age range of 13 to 34 years (Cong et al., 2022; Zhang et al., 2017), this study specifically targets Chinese youth aged 14 to 33 as the focal population. This age group is particularly relevant to our investigation due to their substantial presence and activity on WeChat, which makes them an ideal sample to examine the impact of network externalities on user behavior. In line with previous studies in the WeChat context, eligible participants were defined as active monthly WeChat users who had sent at least one message in the preceding month. This targeted sampling aligns with the study's objective to explore the factors that influence sustained engagement and usage within this key user base.

The online survey method was selected for this study due to its suitability for exploring the core research theme: the impact of network externalities on WeChat users' perceived gratifications, attitudes and continuous usage behavior within digital environments. This approach is particularly appropriate given the study's focus on online behaviors and interactions, allowing for data collection that is contextually relevant to the medium being examined (Cao et al., 2024; Yang & Lin, 2022). Furthermore, electronic surveys offer several practical advantages: they enable the rapid and efficient collection of data from a broad pool of participants while significantly minimizing both costs and time investment (Li & Shang, 2020; Zhang, et al., 2024). This method not only facilitates access to a diverse and geographically dispersed sample, which enhances the generalizability of the findings, but also supports the study's aim to capture real-time insights into online engagement behaviors (Liu et al., 2018; Pang & Ruan, 2023). The flexibility and scalability of online surveys make them an optimal choice for gathering data, particularly when investigating phenomena that inherently occur in digital contexts. The repliers were anonymously selected from a mobile app named Sojump (www.sojump.com) after getting informed consent during May 8 and June 8, 2024, in mainland China. Sojump is a professional online questionnaire survey website that allows services of survey design and data collection through its large panel database. Finally, a total of 856 qualified individuals filled in the survey. After deleting incomplete and questionable responses, the total number of valid responses was 788.

3.3. Measurements

An online questionnaire was designed including two parts. The initial part mainly consists of seven variables (Referent network size, perceived complementarity, hedonic gratifications, social gratifications, utilitarian gratifications, attitudes toward WeChat, and continuous usage behavior).

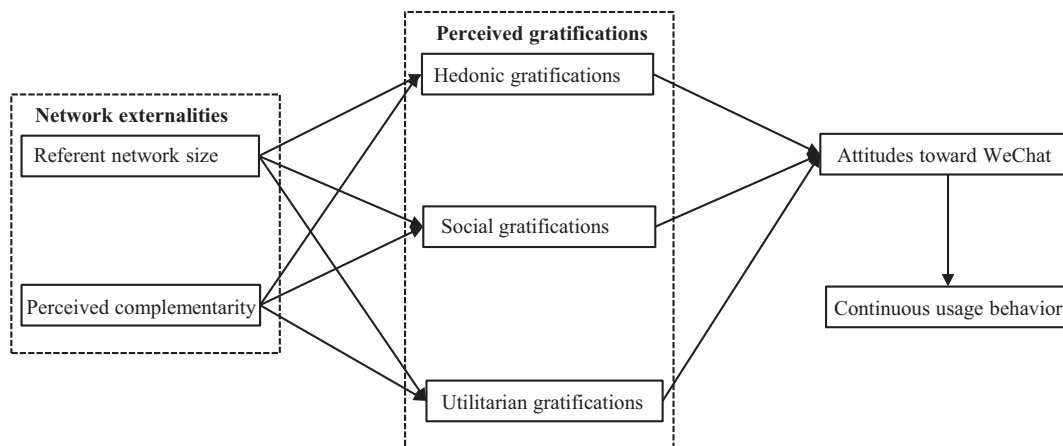


Fig. 1. The proposed research model.
Notes: ** $p < 0.01$, *** $p < 0.001$.

usage behavior) in the research. The second part includes participants' descriptive information such as gender, education level, monthly expenditures, and length of WeChat use. This survey questionnaire conducts a pretest via 60 people who are active users and the outcome indicated that survey statements are comprehended easily. We measured referent network size with two questions which were modified from the study of Zhou and Lu (Zhou & Lu, 2011). The perceived complementarity scale contains four statements and these items were adapted from previous investigations (Lin & Lu, 2011; Zhao & Lu, 2012). The assessment of hedonic gratifications contains three questions which were adapted from the investigation of Zhang, et al. (Zhang et al., 2017). The social gratifications scale was modified from the research of C.-M. Chang and contains three statements (Chang, 2018). The measurement of utilitarian gratifications was altered from previous studies and includes three questions (Lin & Lu, 2011; Zhou & Lu, 2011). Attitudes toward WeChat were measured through three items which were adjusted from existing research (Lien & Cao, 2014). The scale of continuous usage behavior was borrowed from the study of Shaikh, et al. and includes four statements (Shaikh et al., 2015). Total statements were gauged by a five-point Likert scale, ranging from quite disagree (1) to quite agree (5). Table 1 displays a list of measurement items along with their respective sources.

Table 1
Measurement and questionnaire.

Variable	Item	Source
Referent network size	(1) I perceive that WeChat is popular among a large number of people.	(Zhou & Lu, 2011)
	(2) I perceive that WeChat is used by the majority of people.	
	(3) WeChat possesses an extraordinarily extensive user base.	
	(4) I observe that my relatives and friends frequently use WeChat.	
Perceived complementarity	(1) WeChat offers a broad selection of applications.	(Lin & Lu, 2011; Zhao & Lu, 2012)
	(2) WeChat provides a broad array of supporting tools.	
	(3) A diverse range of social activities can be accessed on WeChat.	
	(4) A wide variety of games are accessible on WeChat.	
Hedonic gratifications	(1) I derive considerable pleasure from using WeChat.	(Zhang et al., 2017)
	(2) Using WeChat is an enjoyable experience for me.	
Social gratifications	(1) WeChat provides a convenient method for connecting with others.	(Chang, 2018)
	(2) Utilizing WeChat facilitates the formation of new friendships.	
	(3) WeChat assists in sustaining my relationships with friends and family.	
Utilitarian gratifications	(1) WeChat allows me to access more information and meet more people.	(Lin & Lu, 2011; Zhou & Lu, 2011)
	(2) WeChat boosts my efficiency in information sharing and networking.	
	(3) WeChat serves as an effective platform for member interaction	
Attitudes toward WeChat	(1) I find it comfortable to use WeChat.	(Lien & Cao, 2014)
	(2) I prefer communicating with my friends through WeChat.	
	(3) My attitude toward WeChat is favorable.	
Continuous usage behavior	(1) I will keep using WeChat and not switch to alternatives.	(Shaikh et al., 2015)
	(2) I will continue using WeChat to gain knowledge.	
	(3) I plan to maintain or increase my WeChat usage.	

4. Data analysis

In this current investigation, we conduct a descriptive data analysis to present the complete demographics of respondents, while also offering new insights into the potential impacts of network externalities on various dimensions of users' perceived gratifications, attitudes, and feasible behaviors.

Subsequently, zero-order relationships were implemented aiming at uncover potential relationship among several fundamental constructs while gender, age, educational level, monthly expenditure, and length of use were controlled. Ultimately, SEM method was carried out to clearly examine all structural linkages among these variables. The collected data was analyzed via employing SPSS 25.0 and AMOS 26.0.

5. Results

5.1. Demographic data

The target population of this current investigation comprises WeChat users in mainland China. Based on 788 valid and usable samples collected through online questionnaires, the gender distribution was nearly balanced, with 426 males (54.1 %) and 362 females (45.9 %). Furthermore, the predominant age group ranged from 22 to 25 years old, comprising 52.7 % of the participants. Regarding the education levels, 87.8 % of respondents held a bachelor's degree or higher, underscoring a well-educated demographic. Specifically, 403 individuals possessed a bachelor's degree, while 212 held a master's degree. Additionally, 49.6 % of their monthly expenditures were <3000 RMB. A majority of subjects (approximately 56.9 %) have utilized WeChat over five years. Table 2 displays the demographic details of survey participants.

5.2. Zero-order correlations among main constructs

As shown in Table 3, there is a positive correlation between network externalities and perceived gratifications. Referent network size have positive effects on hedonic ($r = 0.434, p < 0.01$), social ($r = 0.183, p < 0.01$) and utilitarian gratifications ($r = 0.090, p < 0.05$). Perceived complementarity is positively associated with hedonic ($r = 0.260, p < 0.05$), social ($r = 0.094, p < 0.05$), and utilitarian ($r = 0.112, p < 0.01$) gratifications. The discovery indicated that users who possess a larger

Table 2
Descriptive information for respondents (N = 788).

Category	Frequency	Percentage (%)	Mean	S.D.
Gender				
Male	426	54.1		
Female	362	45.9		
Age			2.58	0.84
18–21 years old	34	4.3		
22–25 years old	415	52.7		
26–29 years old	189	24.0		
30–33 years old	150	19.0		
Education level			3.26	0.99
High school or below	96	12.2		
Bachelor degree	403	51.1		
Master degree	212	26.9		
Phd degree	77	9.8		
Monthly expenditure			2.12	1.37
Less than RMB3000	391	49.6		
RMB 3001–6000	150	19.0		
RMB 6001–9000	90	11.4		
RMB 9001–12,000	84	10.7		
Above RMB12000	73	9.3		
Length of WeChat use			2.29	0.56
<1 year	6	0.8		
1–3 years	65	8.2		
3–5 years	268	34.1		
Above 5 years	449	56.9		

Table 3
Zero-order correlations among main constructs (N = 788).

Main constructs	1	2	3	4	5	6	7
1. Referent network size	1						
2. Perceived complementarity	0.301**	1					
3. Hedonic gratifications	0.434**	0.260*	1				
4. Social gratifications	0.183**	0.094*	0.659**	1			
5. Utilitarian gratifications	0.090*	0.112**	0.551**	0.634**	1		
6. Attitudes toward WeChat	0.301**	0.174**	0.726**	0.629**	0.625**	1	
7. Continuous usage behavior	0.268**	0.230**	0.302**	0.256**	0.299**	0.310**	1

* p < 0.05.
** p < 0.01.

referent network size and more perceived complementarity are inclined to obtain higher hedonic, social and utilitarian gratifications. Moreover, perceived gratifications including hedonic ($r = 0.726, p < 0.01$), social ($r = 0.629, p < 0.01$), and utilitarian ($r = 0.625, p < 0.01$) gratifications positively influence attitudes toward WeChat. The outcomes suggest that users who perceive more hedonic, social and utilitarian gratifications may report better attitudes toward WeChat. Additionally, the investigation confirms that attitudes toward WeChat are important predictor of continuous usage behavior ($r = 0.310, p < 0.01$). This indicated that users possess greater levels of attitudes tend to produce continuous usage behaviors.

5.3. Assessment of the research model

According to an analytical approach proposed by Anderson and Gerbing (Anderson & Gerbing, 1988), the two-step method is adopted to assess this research model. The first step of this approach is to adopt confirmatory factor analysis (CFA) to evaluate the measurement model. All model fit indices exceeded the recommended values, and the model's internal consistency also met the standard threshold of 0.7. Additionally, the standard factor loadings and the average variance extracted (AVE) for each construct exceeded 0.5, and the composite reliability (CR) values surpassed the required threshold of 0.7, indicating good convergent validity. In discriminant validity, every AVE exceeds the correlation coefficients of the constructs confirmed good discriminant validity. Thus, the measurement model displays required reliability, convergent validity, and discriminant validity. Secondly, AMOS 26 was utilized to examine the model fit indices ($\chi^2/d.f. = 2.473$; RMSEA = 0.020; RMR = 0.015; CFI = 0.989; AGFI = 0.946; IFI = 0.989; TLI = 0.954) and the outcomes suggested a suitable model fit. As expected, referent network size is found to positively affect perceived hedonic ($\beta = 0.230, p < 0.001$), social ($\beta = 0.181, p < 0.01$) and utilitarian ($\beta = 0.142, p < 0.01$) gratifications. Thus, H1, H2, and H3 were statistically supported. Likewise, perceived complementarity is discovered to have positive influence on perceived hedonic ($\beta = 0.273, p < 0.01$), social ($\beta = 0.119, p < 0.01$), and utilitarian ($\beta = 0.257, p < 0.001$) gratifications. Hence, H4, H5, and H6 were all supported. Moreover, the results have identified that perceived hedonic ($\beta = 0.611, p < 0.001$), social ($\beta = 0.282, p < 0.001$), and utilitarian ($\beta = 0.386, p < 0.001$) gratifications exert positive impact on attitudes toward WeChat. Accordingly, H7, H8, and H9 were verified. Lastly, attitudes toward WeChat ($\beta = 0.181, p < 0.001$) obviously affect continuous usage behavior suggesting that it is a determinant of continuous usage behavior. The study further explores the mediating roles of perceived gratifications, examining the links between various types of perceived gratifications, user attitudes, and continuous usage behavior within the WeChat environment. The bootstrapping analysis confirms that the indirect effects of referent network size on attitudes via hedonic gratifications, social gratifications, and utilitarian gratifications were positive and significant, with 95 % CIs (confidence intervals) of [0.022, 0.093], $\beta = 0.051$; [0.021, 0.100], $\beta = 0.053$; and [0.031, 0.112], $\beta = 0.068$. Similarly, the indirect effects of perceived complementarity on attitudes via hedonic gratifications, social gratifications, and utilitarian gratifications were also both positive

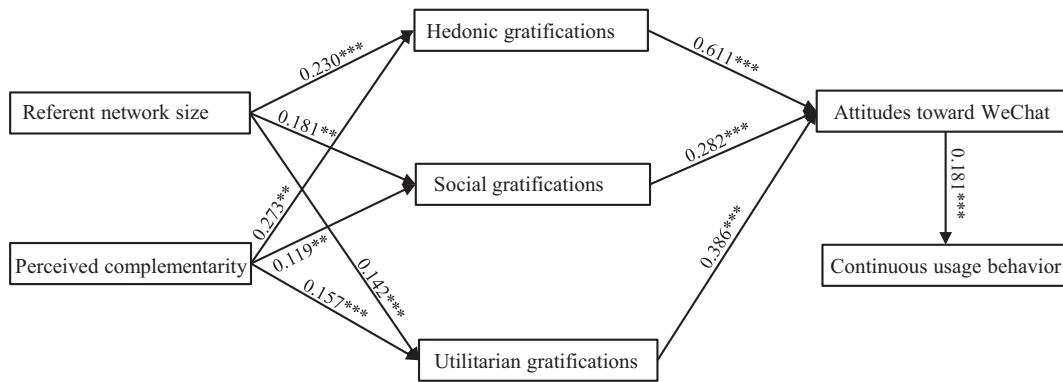
and significant, with 95 % CIs [0.025, 0.076], $\beta = 0.057$; [0.029, 0.096], $\beta = 0.059$; [0.037, 0.118], $\beta = 0.36$. The results of hypotheses testing and path coefficients are displayed in Fig. 2. and Table 4.

6. Discussion

6.1. Summary of main findings

According to network externalities theory and U&G theory, this study aims to explore the antecedents of perceived gratifications and continuous usage behavior via WeChat and sheds light on the research field of users' behavior. Firstly, the research results have suggested that both referent network size and perceived complementarity are significant predictors of hedonic gratifications, social gratifications and utilitarian gratifications. These findings are consistent with results of existing literature, indicating that perceived gratifications would be facilitated with referent network size increases (Chang, 2018; Cheng, 2020; Tjahja & Potjomkina, 2024). WeChat is identified as an easy and convenient usage channel that permits consumers to communicate frequently with others and obtain more valuable information easily (Chang, 2018; Liao et al., 2021). Thus, users' perceptions of social and utilitarian gratifications are likely to intensify with the expansion of their network size and the increasing awareness that more people are joining, which in turn encourages continued use of mobile social media. Moreover, with the expansion of referent network size, consumers may gain increased opportunities to maintain contact with a broader peer group and to establish interest groups, facilitating conversations with individuals who share similar interests (Flecha-Ortiz et al., 2023; Yang et al., 2022; Zhang et al., 2017). It will generate more enjoyment and pleasure for users and greatly enhance perceived hedonic gratifications (Ju et al., 2022). Further, our findings demonstrate that perceived complementarity significantly exerts a profound impact on social gratifications and utilitarian gratifications. These discoveries are similar to prior researches (Cheng, 2020; Tang et al., 2021; Tjahja & Potjomkina, 2024), which offered additional evidence to demonstrate that users acquire perceived gratifications from complementary goods and services (Ma, 2021; Singh et al., 2023). In a similar line, perceived complementarity predicts increased hedonic gratifications, indicating that social interactions become more interesting as complementary services and tools are added.

Secondly, our research revealed that perceived gratifications, encompassing hedonic, social, and utilitarian aspects, exert a significant influence on attitudes toward WeChat. This finding aligns with existing research that connects perceived gratifications with affective factors, including attitudes and satisfaction associated with WeChat usage (Lyu, et al., 2024; Makanyeza et al., 2016; Pang, 2021). A prior study suggested that hedonic gratifications can lead to more positive emotions and attitudes toward WeChat (Pang, 2021). Through providing convenient and accessible products and services to satisfy the entertainment motivations and gratifications of users to build deeper trust with users (Flecha-Ortiz et al., 2023; Phua et al., 2017), which can greatly improve users' attitudes toward WeChat. Our findings also demonstrate that the relationship between social gratifications and attitudes toward WeChat



Notes: **p < 0.01, ***p < 0.001

Fig. 2. The path analysis results.

Table 4
Confirmation of the study hypotheses (N = 788).

Hypotheses	Path results	Support
H1	Referent network size → Hedonic gratifications	Yes
H2	Referent network size → Social gratifications	Yes
H3	Referent network size → Utilitarian gratifications	Yes
H4	Perceived complementarity → Hedonic gratifications	Yes
H5	Perceived complementarity → Social gratifications	Yes
H6	Perceived complementarity → Utilitarian gratifications	Yes
H7	Hedonic gratifications → Attitudes toward WeChat	Yes
H8	Social gratifications → Attitudes toward WeChat	Yes
H9	Utilitarian gratifications → Attitudes toward WeChat	Yes
H10	Attitudes toward WeChat → Continuous usage behavior	Yes

is consistent with previous research, which suggests that higher perceived social gratifications are associated with more positive attitudes toward WeChat (Carpentier et al., 2019; Chen et al., 2018; Xuan et al., 2024). One possible reason for this is that WeChat provides a channel for the establishment and maintenance of social relationship and fulfillment of social needs which lead to positive attitude of users (Ten Bruggencate et al., 2019). It implies that mobile social media allows people to perceive social support and gratifications in the social interaction process, thus they may be more likely to exhibit more positive attitudes and build inner satisfaction.

Additionally, this current research has demonstrated utilitarian gratifications could positively influence individuals' attitudes toward WeChat. The outcome is consistent with prior researches (Ashraf et al., 2019; Pang, 2021; Xuan et al., 2024) indicating utilitarian gratifications are main drivers of users' affective factors like attitudes toward WeChat. A plausible explanation for this result is that WeChat as the most widely used application frequently provides significant content validity on products and services and facilitates users engaging in timely interactions with valuable information (Flecha-Ortiz et al., 2023; Lien & Cao, 2014; Zhu et al., 2020), which eventually leads to the improvement of users' perceived gratifications and attitudes toward WeChat.

Lastly, attitudes toward WeChat are deemed to positively affect continuous usage behavior. The findings are consistent with many researchers (Cao et al., 2024; Guo et al., 2020; Liu et al., 2018) that also demonstrated a positive relationship between affective factors and continuous usage behavior through digital media technology. Sabah posited that users' continuous engagement with products or services is primarily influenced by their attitudes toward these offerings (Sabah, 2020). In fact, attitude is proven to be the antecedent of behaviors, and SNSs are emotional-oriented information systems (Liébana-Cabanillas et al., 2014; Wang et al., 2022). Therefore, attitude can be regarded as a strong predictor of continuous usage behavior on social networks. In the digital media era, users typically interact with old friends and forge

connections with new ones on social media platforms such as WeChat. Consequently, when users perceive greater gratifications and develop a positive attitude, they are more inclined to continue using mobile SNS.

6.2. Theoretical and practical implications

Grounded in U&G theory and the concept of network externalities, this study proposes an integrated conceptual framework to examine the attitudes and determinants influencing users' sustained engagement with WeChat. This framework not only elucidates the mechanisms driving continuous usage but also integrates network externalities as pivotal determinants, advancing further theoretical understanding in several key areas. First, the study delineates the dual dimensions of network externalities including referent network size and perceived complementarity within the burgeoning field of digital media. This distinction provides a robust theoretical basis for considering network externalities as critical precursors to perceived user gratifications. Second, the findings reveal the significant role of perceived gratifications in shaping user attitudes and fostering ongoing engagement with WeChat. By empirically confirming that perceived gratifications enhance positive attitudes toward WeChat, which in turn promote sustained usage, our study extends prior research and offers a nuanced view of user interaction dynamics in social media platforms. Third, addressing a gap in the existing literature, this research explores the mediating role of user attitudes in the relationship between perceived gratifications and continuous usage behaviors. While previous studies have noted the direct impact of perceived gratifications (Li et al., 2018; Li & Shang, 2020; Singh et al., 2023), this analysis underscores the importance of attitudinal mediation, thereby enriching the theoretical discussion surrounding user engagement in the context of mobile technology. Thus, this paper not only deepens the empirical understanding of user behavior in mobile social media but also provides theoretical insights that can guide future research in the era of mobile technology. By elucidating the interplay between network externalities, user gratifications, and attitudinal shifts, it contributes a valuable framework for exploring digital media's evolving landscape.

From a managerial perspective, the acquired results also offer crucial implications for mobile social service practitioners and managers to maintain users' continuance usage behavior. Firstly, based on the obtained results, perceived gratifications play a major role in the formation of positive attitudes toward WeChat which further influence continuous usage behavior. Therefore, practitioners and managers of mobile social media could implement strategies to fulfill users' perceived gratifications during their engagement with these platforms. For instance, developers could augment the functionality of mobile social media by regularly creating and updating innovative, convenient, and practical applications. These enhancements should cater to users' needs for

entertainment, social interaction, and information-seeking, thereby enhancing perceived gratifications and reinforcing user loyalty. Secondly, network externalities were discovered to be a significant predictor of perceived gratifications for users, indicating the significance of network externalities in consumers' gratifications in digital social media era. Therefore, WeChat managers should take measures to increase the network externalities, so further particularly enhancing hedonic gratifications, social gratifications and utilitarian gratifications. For example, practitioners of mobile social services could design and develop a variety of engaging activities to attract more participants, thereby enhancing the network size of social media platforms. Moreover, social media providers should create and offer a range of complementary goods and services that are more value-added, compatible, and captivating. These strategies could also serve as insights for other social media developers. Lastly, WeChat managers could adopt some incentive mechanisms to enhance users' attitudes and satisfaction and further strengthen users' continuance usage intention.

6.3. Limitations and scope for future research

Despite the study offers valuable findings and new insights regarding network externalities of mobile social media and continuance usage behavior, there are still several inevitable limitations and valuable directions to be explored. Firstly, the results of this research are from a single study used data and samples in mainland China. To generalize the findings to different countries, future research should conduct investigations in the context of different countries especially some countries with strong cultures of individualism to test whether the results are different. Secondly, future studies should assess the generalizability across various mobile social applications, as different social media platforms may influence users' gratifications, subsequently affecting satisfaction levels and usage behaviors. Lastly, while a cross-sectional study was primarily employed in this article, it is essential to recognize that users' attitudes and behaviors are dynamic and evolve over time. Therefore, future research will incorporate a longitudinal study to capture these temporal changes and offer new insights into continuance usage behavior. Additionally, experimental designs may also be considered in future work to effectively explore causal relationships that cannot be methodologically captured through cross-sectional survey approaches.

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CRedit authorship contribution statement

Hua Pang: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Yuxin Qiao:** Writing – original draft, Software, Methodology, Investigation, Formal analysis. **Yanran Li:** Writing – review & editing, Resources, Project administration, Methodology, Investigation. **Lei Wang:** Writing – review & editing, Resources, Methodology, Investigation, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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