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How WeChat can retain users: Roles of network externalities, social interaction ties, and perceived values in building continuance intention

Chu-Bing Zhang^{a, b}, Yi-Na Li^{b, *}, Bo Wu^a, Dong-Jin Li^b^a Business School, Tianjin University of Finance and Economics, 25# Zhujiang Avenue, Tianjin, 300204, PR China^b Business School, Nankai University, 121# Baidi Road, Tianjin, 300192, PR China

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ABSTRACT

An increasing number of users join and immerse in Social Network Services' (SNS) virtual spaces, but many users quit using these services as well. SNS managers must enhance users' continuance intention. Based on a survey of WeChat users, this research examined the effects of direct and indirect network externalities on users' perceived values (including social value, information value, emotional value, and hedonic value) and continuance intention. We conducted data analysis with structural equation modeling (SEM). Results confirmed that social interaction ties mediate the effect of network externalities on the four types of perceived values. Meanwhile, among the four types of perceived values, only social value and hedonic value influence continuance intention.

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1. Introduction

Repeatedly updating social events which are shared on Social Network Services (SNS) has become a pervasive phenomenon in the digital era. People spend long periods of time to extend and maintain relationships (Boyd & Ellison, 2007; Ellison, Steinfield, & Lampe, 2007; Lin & Lu, 2011a; Powell, 2009) by updating their online status; sharing videos, photos, and knowledge; presenting their online profiles; giving thumb-ups and comments (Ellison et al., 2007; Lin & Lu, 2011a; Powell, 2009); and participating in entertainment activities with others. An increasing number of users have adopted, immersed, and even been addicted to the digital world. One might refute the belief that "I share therefore I am" and blame SNS for isolating users from face-to-face interaction and a truly motivated life. However, we could not deny the benefit we could acquire from participating in online interactivities (Al-Debei, Al-Lozi, & Papazafeiropoulou, 2013; Lee, Yen, & Hsiao, 2014). Our research aims to explore why users continue to use WeChat in their daily lives.

We empirically explored users' continuance intention to use WeChat, a popular SNS application with more than 700 active million active daily users in China as of April 2016. WeChat provides services similar to those of Facebook and Facebook Messenger. Users can engage in social interactivities with reduced cost of admission. Compared with parasocial interactions between strangers in virtual reality (e.g., Ha & James, 1998; Liu & Shrum, 2002; Yoo, Lee, & Park, 2010; Zhao & Lu, 2012), interaction on WeChat is made between people who have been connected offline.

WeChat plays a passive role, merely as the interface of offline social connections. WeChat duplicates, transfers, represents, and facilitates offline personal connections. Information is shared exclusively between mutual friends and not for the general public. WeChat neither builds a new realm apart from the offline world nor recommends new friends by computing mutual friend connections. We adopt the view of perceived values to explore the ways in which WeChat can retain users. Existing literature has indicated that network externalities can enhance SNS users' perceived usefulness and enjoyment (Lin & Bhattacherjee, 2008; Lin & Lu, 2011b; Zhou & Lu, 2011). However, this dichotomy of perceived value failed to specify the social value and emotional value (e.g., Balakrishnan & Shamim, 2013; Lin, 2011) and did not discuss the different influences of each type of perceived value on continuance intention. Our research compares the effects of different perceived values and

* Corresponding author.

E-mail addresses: zcbhrj@139.com (C.-B. Zhang), yina@nankai.edu.cn (Y.-N. Li), wubo212006@126.com (B. Wu), djli1280@163.com (D.-J. Li).

provides insight into understanding users' continuance intention.

After WeChat has been developed into a platform that integrates instant messaging, voice chatting, shopping, gaming, and banking, the effect of each function on users' different types of perceived values needs to be identified. The multiple dimensions of perceived values can provide insight into thoroughly understanding the needs and wants of users and support the strategic decision on strengthening or modifying particular functions. In addition to providing more evidence consistent with the literature pertinent to the effect of network externalities on perceived values and continuance intention to use SNSs (e.g. Lin & Lu, 2011b), we explicitly explain the influence of network externalities on each perceived value and the different weighted influences of each perceived value on users' continuance intention.

Furthermore, the existing literature has indicated that network externalities would enhance social interaction ties (Wang & Chen, 2012), and intense interaction would boost the perceived values (e.g., Yoo et al., 2010). We empirically test the mediating role of social interaction ties in the effect of network externalities on different perceived values. We highlight the connection of social relationship building and maintenance between the virtual space and the offline world.

In summary, we build a model to explain the effects of network externality on users' perceive values, the mediating role of social interactivity ties in such effects, and the effects of different perceived values on users' intention to use. This research provides insight into SNS users' behavior and managerial implications to retain users.

2. Literature review

2.1. Network externalities

Network externalities refer to “the utility that a user derives from consumption of the good increases with the number of other agents consuming the good” (Katz & Shapiro, 1985, p. 424). An increasing number of users provides added benefits to existing users. Network externalities can be classified into direct network externalities and indirect network externalities (Katz & Shapiro, 1985).

Direct network externalities emphasize on the benefits generated by new participants. Direct network externalities arise depending on the total number of purchasers or users of the same network product (Chiu, Cheng, Huang, & Chen, 2013; Katz & Shapiro, 1985). As new participants join the network product, such as WeChat, existing users can share information, build connections with more potential participants, and thus access to greater network utility (Lin & Bhattacharjee, 2008). Therefore, most studies consider network size as a major component of direct network externalities (e.g., Chiu et al., 2013; Lin & Lu, 2011b; Zhao & Lu, 2012).

Network size determines the potential contacts that a user may get in touch with but does not guarantee either the virtual connections that a user can build or the utilities provided by the connections (Lin & Bhattacharjee, 2008, 2009; Lin & Lu, 2011b). Mutual friends on WeChat are basically family members, friends, and acquaintances offline. People are more motivated to maintain relationships using this application when their peers also use it. Scholars have concluded that people respond more favorably to the message that invokes their identity (Bhattacharjee, Berger, & Menon, 2014; Reed, Forehand, Puntoni, & Warlop, 2012). For example, those with a salient student identity evaluate a publication more positively after reading messages describing its relevance to the group of students (Reed, 2004). People of similar age are “linked by similar world view because they share common life-

shaping experiences during their late teens and early twenties” (Yoon, Cole, & Michelle, 2009). Therefore, the number of peers, as a component of direct network externalities, increases usage (Lin & Lu, 2011b).

By contrast, indirect externalities refer to the accruing benefit from the increasing number of participants, including the average price reduction and more available service that producers can provide (Chiu et al., 2013; Lin & Bhattacharjee, 2008). For example, when more people start using tablets, the price of each unit fell, and more applications were developed. The indirect network externalities also apply to SNSs. Indirect network externalities arise when the networks are able to provide complementary goods or services (Chiu et al., 2013; Lin & Bhattacharjee, 2008). Previous studies modeled compatibility and perceived complementarity as components of indirect network externalities (Lin, Tsai, Wang, & Chiu, 2011). WeChat has developed many auxiliary functions, including blogging, shopping, gaming, and even banking. Aside from the services available, compatible access to services out of the network can also optimize participants' bond to WeChat. To summarize, we can use complementarity and compatibility to indicate the indirect network externalities.

2.2. Social interaction ties

Social interaction refers to an interpersonal action or a relationship between an individual and others (Varey, 2008; Wang & Chen, 2012). This concept is initially used in theory of community social organizations, as a structural dimension of social capital (Lin & Lu, 2011a; Nahapiet & Ghoshal, 1998). Social capital highlights the resources and functioning of interpersonal networks, which are developed over time and provide the basis for trust, cooperation, and collective actions in a community (Jacobs, 1965). Social capital is accessed and mobilized in a deliberate action (Lin & Bhattacharjee, 2009; Lin, 2011; Song & Lin, 2009).

Applied to SNSs, social interaction ties pertain to individual perceptions relating to familiarity and frequency of communication with other online community members (Wang & Chen, 2012). Specifically in WeChat, which helps family members, friends, and acquaintances to maintain relationships and helps strangers in building connections exclusively online, social interaction ties suggest a transfer of social capital from offline to online. Online social relationships draw power from offline social resources. The SNSs are media for interpersonal communication (Blattberg & Deighton, 1991; Stromer-Galley, 2000), with higher controllability over messages (Liu & Shrum, 2002) and improved convenience (Ha & James, 1998; Yoo et al., 2010).

In the studies of online communities, social interaction ties are measured by “the level of frequency and time investment of online community member interactions” (Wang & Chen, 2012). Similarly, we measure WeChat users' social interaction ties using the frequency and time investment of interacting with WeChat friends.

Prior research has confirmed that network externalities can positively influence social interaction ties (Wang & Chen, 2012). Furthermore, social interaction ties can positively influence trust in member and relationship commitment in an online community, shared value, trust, and continuance intention to use SNSs (Lin & Lu, 2011a; Wang & Chen, 2012). We propose that network externalities can enhance the interactivities between users, increase perceived values, and lead to high continuance intention to use WeChat.

2.3. Perceived values

Perceived value, which is well-documented in marketing research, refers to an overall assessment made by users for a

product or service (Zeithaml, 1988). It basically involves the discrepancy between the benefits they earn and the cost they must pay. The existing literature classifies the dimensions of perceived values based on two perspectives. In terms of users' motivation, users seek for utilitarian value and hedonic value (Mano & Oliver, 1993; Park & Park, 2009). Alternatively, in terms of goal orientation, perceived values are categorized into extrinsic values (economic value and social value) and intrinsic values (hedonic value and altruistic value) (Holbrook, 2006). In using scenarios, perceived values are specified as functional value, conditional value, social value, emotional value, and epistemic value (Sheth, Newman, & Barbara, 1991).

After adopting SNSs, users compare their experiences and the performance of the products and services with their expectations. Existing research on SNSs considered perceived value as a one-dimensional construct (Al-Debei et al., 2013) or as perceived usefulness and enjoyment (Lin & Bhattacharjee, 2008; Lin & Lu, 2011a; Zhou & Lu, 2011). Although the influence of perceived values on Facebook's continuance participation intention has been supported by previous studies (Al-Debei et al., 2013), whether different types of perceived values influence users' continuance intention equally is unclear.

According to motivation theory (Lin & Lu, 2011b), in our research, we classify the perceived values of WeChat into social value, information value, emotional value, and hedonic value. In particular, social value refers to users' perceived usefulness in representing themselves, effectively building and maintaining interpersonal relationships, seeking companionship or verbal reinforcement, and pursuing social approval (Cutrona & Suhr, 1992; Hirsch, 1980; Lin, 2011). Users can acquire this benefit by transferring their offline relationships to the WeChat platform and interacting with one another. Information value indicates the benefit from acquiring useful information from friends or professional information providers on WeChat. Users apply the information to solve problems or enhance one's skill and ability. Emotional value pertains to the emotional comfort and satisfaction obtained from online social support and interactions (e.g., expressions of care, concern, affection, and sympathy, which help one overcome his or her loneliness) (Balakrishnan & Shamim, 2013; Lin, 2011; Taylor, 2011). Hedonic value refers to pleasure, excitement, and enjoyment experienced by interacting with friends and participating in entertaining activities provided by WeChat's auxiliary functions. Among these four types of perceived values, social value and information value are pursued to achieve extrinsic goals. By contrast, emotional value and hedonic values are motivated by intrinsic values, that is, using WeChat per se is the goal and is not driven by any other enforcements.

3. Hypothesis development

3.1. Network externalities and social interaction ties

Human beings are born to pursue attachment with others (Reis & Patrick, 1996; Zhao & Lu, 2012). WeChat definitely provides tools to benefit personal communication. First, an increased population in the network would increase users' possibility to link to others, transfer their offline social relationships online, and enhance the social interaction ties. Studies have noted that an online community with a larger number of members is more inclined to stimulate active interaction and communication (Wang & Chen, 2012). In other words, network size can positively influence social interaction ties. People use SNS as the stage to show their ideal identity to potential audiences (Goode & Robinson, 2013). Second, users may be influenced more by their peers of similar world view and common life-shaping experiences (Yoon

et al., 2009). Their belief that they belong to a certain group and their awareness that they are communicating with peers will force them to join the group of peers, share information, and experience auxiliary functions collectively. Therefore, the number of peers can positively influence social interaction ties. Thus, we hypothesize:

H1-1. Direct network externalities positively influence social interaction ties.

An increasing number of participants of a network promotes the development and optimization of products services and leads to more technique choices and better functions. As WeChat has been developed into a platform that integrates various auxiliary functions of high compatibility and complementarity, users can experience more types of interactions with other WeChat users. For example, online games provide shared fun, whereas banking services facilitate financial transfers. Previous research has shown that high complementarity leads to high perceived interactivity of a micro-blogging service (Zhao & Lu, 2012). Therefore, we hypothesize:

H1-2. Indirect network externalities positively influence social interaction ties.

3.2. Network externalities and perceived values

Network externalities affect users' perceived value (Lin & Bhattacharjee, 2008; Lin & Lu, 2011b). The perceived values are produced from the increasing number of users, the number of peers in their social circle, and the compatible and complementary products and services in the network (Lin & Bhattacharjee, 2008; Lin & Lu, 2011b; Zhao & Lu, 2012; Zhou & Lu, 2011).

The increasing number of members on an SNS platform can bring more benefits to users (Lin & Bhattacharjee, 2008; Lin & Lu, 2011b; Zhao & Lu, 2012; Zhou & Lu, 2011). According to the theory of reference groups, individual behavior is influenced by group membership (Hyman, 1942). People will exert effort to keep up with other members, for example, by joining and using the same SNS. An increasing number of users who adopt WeChat generates the attraction for non-users to adopt the platform to communicate conveniently and confirm their identity as a member of a certain group. An increasing number of users implies a high probability for a user to connect with more people and to strengthen the attraction.

Given the influences of the number of peers on social value, users are more likely to link their offline social network and create an alternative way to contact, rather than to make new friends (Boyd & Ellison, 2007). A user is motivated to manage other people's impression of them, maintain desired images, and gain positive social values (Krämer & Winter 2008). An SNS used by more peers can help self-presentation efficiently. Therefore, we propose that:

H2-1. Direct network externalities positively influence social value.

SNS provides a useful channel for sharing vital information (Balakrishnan & Shamim, 2013). A user can become acquainted with the world outside his or her individual network by reading more user-generated content (UGC). When a network has more users, more UGC is probably produced. When one has more peers as online friends, he or she gains greater opportunity to learn the latest updates on their topics of interest. In the chaotic deluge of information, the information shared by peers on social media may be more relevant because of similarities between

peers.

Subscription is another information resource on WeChat. The contents are provided by professional generators. A large number of users can attract more producers and motivate them to create more customized content for various user groups. Thereafter, subscribers can access their personalized subscription and gain more information values. Therefore, we hypothesize that:

H2-2. Direct network externalities positively influence information value.

Social networking groups are considered as an appropriate venue to discuss emotions and experiences (Neubaum, Rösner, Rosenthal-von der Pütten, & Krämer, 2014). On WeChat, a user can express emotion by updating about personal events. When confronted with a negative emotion, a user who starts a conversation using WeChat more likely earns instant responses, emotional support, and encouragement. In daily life, the shared contents, thumbs-ups, and comments from other users can evoke emotional resonance among users. Therefore, we hypothesize that:

H2-3. Direct network externalities positively influence emotional value.

The hedonic value on WeChat comes from two types of resources. First, interacting and sharing information with others *per se* can create senses of pleasure (Lin & Lu, 2011b; Powell, 2009). Second, entertaining texts, pictures, videos, and applications can produce hedonic values. A large number of users are more likely to introduce rich resources for fun. Meanwhile, a large number of peers potentially means participating in favorite entertainment with like-minded people. Therefore, we propose that:

H2-4. Direct network externalities positively influence hedonic value.

In addition to the value provided by direct network externalities, higher indirect networking externalities (i.e., higher compatibility with other resources and more available services and supporting tools) can help users to show themselves, interact with others, and increase perceived values (Lin & Lu, 2011b; Powell, 2009; Tapscott, 2008).

WeChat provides complimentary functions for communication and compatible access to various services. These functions and services are helpful for users' impression management and relationship maintenance. As a mediated interface, WeChat allows users to employ digital techniques and multimedia to create their image that is different from the reality. For example, users may adopt powerful facial beautification software to embellish their pictures for sharing. The available methods for manipulating information can bring high social value to users. In terms of relationship maintenance, WeChat provides methods to digitalize one's offline relationship into the virtualized world. Users can build their online connections based on their cell phone contact lists. Users can also build and join chat groups and virtualize the face-to-face communication in a conference room into events in digital space. We propose that:

H3-1. Indirect network externalities positively influence social value.

Previous research highlights the information value of SNSs. It indicates that high complementarity can lead to high perceived usefulness (Lin & Lu, 2011b; Zhou & Lu, 2011). Complementarity and compatibility can reduce the barriers to information dissemination and enhance information communication. We propose that:

H3-2. Indirect network externalities positively influence

information value.

Apart from the thumbs-ups and comments, the third part has developed voting and donation platform to express one's preferences and willingness to help. The experiences on such functions and services can benefit the action that is convenient in showing emotional support. Therefore, we hypothesize that:

H3-3. Indirect network externalities positively influence emotional value.

Previous research has provided evidence to support the finding stating that high complementarity of an SNS leads to high perceived enjoyment (Lin & Lu, 2011b; Zhao & Lu, 2012; Zhou & Lu, 2011). Games, music, avatar shows, and other entertainment applications have been developed as popular products on WeChat. Users can have fun by themselves or play with friends, such as organizing a team to play Online Karaoke. High compatibility to various entertainment resources on other platforms is also supposed to improve hedonic values. Accordingly, we propose that:

H3-4. Indirect network externalities positively influence hedonic value.

3.3. Social interaction ties and perceived values

We emphasize on the effect of interpersonal interactivities on perceived values. The existing literature on service has indicated that interactions between customers can influence customer evaluation of the service experience (Wu, 2008) and the selection of a certain product (Murphy, 2001). Research on online communities also provides evidence on the effect of social interaction ties on perceived values in terms of trust. We assume that the rules for offline relationships can be applied in the virtual space of WeChat.

The higher the frequency and the longer the time people use WeChat to maintain and expand relationships, the more likely they are to consider it reliable in connecting with people and expressing social identity. When the belief that "using WeChat to stay with friends" is established, users would experience the social norm that they are supposed to respond to when they are needed and wanted. Normative beliefs (Bicchieri & Mercier, 2014) would impose pressure on users to frequently interact and communicate with their WeChat friends. In addition, the active users of WeChat are more likely to add new friends and expand their social connections. In summary, intense social interaction ties on WeChat will make social activities obligatory and enhance the social value. Therefore, we propose that:

H4-1. Social interaction ties positively influence social value.

Users who have transferred their social capital online and have spent significant time and energy to maintain their relationships are supposed to be exposed to frequent information exchange and to benefit from such information. Moreover, a user who has strong social ties on WeChat is more likely to receive recommended and needed information from his or her friends. Therefore, we posit that:

H4-2. Social interaction ties positively influence information value.

Previous research has indicated that more active members of an online community perceived their relationship with other members to be more definite and perceived one another to be more trustworthy (Wang & Chen, 2012). Friends on social media can provide great benefit to those experiencing low self-esteem and low life satisfaction (Ellison et al., 2007). More active users on WeChat are more likely to have strengthened social interaction ties.

Therefore, they are more likely to gain emotional comfort from others and provide emotional support to others. We infer that:

H4-3. Social interaction ties positively influence emotional value.

As more active users can gain more opportunities to learn the online language, code, and communication rituals and build higher levels of trust with their online friends, their interaction and sharing are more likely to bring more pleasure (Lin & Lu, 2011b; Powell, 2009; Tapscott, 2008). Furthermore, more active users are supposed to be more capable of employing auxiliary functions for entertainment with their friends. The shared experiences can increase the fun that they attain. Therefore, we hypothesize that:

H4-4. Social interaction ties positively influence hedonic value.

3.4. Perceived values and continuance intention

People prefer a maximized value in their decision-making processes (Gupta & Kim, 2010). Many studies have confirmed the positive influences of perceived values on behavioral intention and actual behavior (Al-Debei et al., 2013; Sweeney, Soutar, & Johnson, 1997). We propose that specified types of perceived value can influence continuance intention.

Empirical research on technology acceptance has proven that the salience of perceived usefulness and enjoyment has had positive influences on information technology usage intention (Lin & Bhattacharjee, 2008; Lin & Lu, 2011a). After users regard WeChat as a solidified and reliable communication path to their reliable and trustworthy social connections, rich information resources, emotional comforts, and enjoyments, we can infer that in general, four types of perceived values will positively influence continuance intention. We posit that:

H5-1. Social value positively influences continuance intention.

H5-2. Information value positively influences continuance intention.

H5-3. Emotional value positively influences continuance intention.

H5-4. Hedonic value positively influences continuance intention.

4. Method

The subjects of our research are WeChat users in Mainland China. An online questionnaire was designed to collect data through a survey website, namely, www.sojump.com. The survey was distributed for a week. We set the screen questions to select the WeChat users. A total of 240 subjects participated in this survey and completed all questions. A total of 60 uncompleted questionnaires were discarded.

The numbers of friends on subjects' WeChat list are between 2 and 780. The average number is 109.48. Specifically 40.4% subjects are male, and 59.6% are female. More than 90% participants have at least college experiences and more than 3000 RMB income per month. Table 1 shows the demographical information of the subjects.

To avoid postulated relations in the PLS path model influenced by the data collection process and common method variance, we adopted single-factor test (Harman, 1976) to test our data for common method bias (Podsakoff & Organ, 1986). The first factor, which was extracted using principal axis factoring without rotation, accounts for only 33.68% of the overall variance. Therefore, no general factor is apparent, and common method variance is not a critical issue for our analysis (Podsakoff & Organ, 1986).

The construct of multi-item scales is based on theoretical and empirical literature. Direct network externalities are conceptualized as a two-dimensional construct with the dimensions relating to the network size and number of peers. Indirect network externalities are a composite of its two lower-order dimensions, compatibility, and complementarity.

We adopted existing measurement scales validated in prior research to measure network size (Lin & Lu, 2011a), number of peers (Lin & Lu, 2011a), complementarity (modified from Lin & Lu, 2011a), compatibility (Chiu et al., 2013), social interaction ties (Lin & Lu, 2011b; Wang & Chen, 2012), social value (Lee et al., 2014), information value (Lee et al., 2014; Lin & Lu, 2011a), emotional value (modified from Lin, 2011), hedonic value (Lin & Bhattacharjee, 2008; Lin & Lu, 2011a), and continuance intention (Bhattacharjee et al., 2014; Zhao & Lu, 2012). Table 2 illustrates the measurement in detail.

5. Analysis and results

We use variance based PLS-SEM approach to estimate structural equation model. Based on a series of ordinary least squares regression, this approach is prediction oriented and not sensitive to small sample size, well fitting for our research. We use SmartPLS 2.0 to compute the path model and parameters estimation.

5.1. Measurement assessment

We assessed the reliability and the validity of measures models. As shown in Table 2, most indicators have outer loadings of above 0.70, and all the loadings are statistically significant at $p < 0.001$. A score for the outer loading over 0.5 can be acceptable when other items measure the same construct (Chin, 1998).

Hence, the indicators in the measurement models reach satisfactory indicator reliability levels. In addition, Cronbach's alphas for all constructs are above 0.6, which shows that the internal consistency of each construct is very good (Bagozzi & Yi, 1988). Meanwhile, the measurement models achieve composite reliability values of 0.812 and higher, providing evidence of the construct measures' internal consistency reliability (Gefen, Straub, &

Table 1
Subjects' demographics.

Measure	Item	Frequency	Percentage (%)
Gender	Male	97	40.4
	Female	143	59.6
Age	18–25	29	12.1
	26–30	113	47.1
	31–40	81	33.8
	41–50	13	5.4
	51–60	3	1.3
	>60	1	0.4
	High School	2	0.8
Education	3-Year College	15	6.3
	4-Year University	197	82.1
	Master	24	10
	Ph.D.	2	0.8
Occupation	Students	8	3.3
	Officer	19	7.9
	Manger	21	8.8
	Employee	168	70.0
	Teacher	21	8.8
	Others	3	1.3
	Income/month (RMB)		
	<3000	19	7.9
	3001–6000	89	37.1
	6001–9000	85	35.4
	9001–12,000	29	12.1
	>12,000	18	7.5

Notes: * $p < 0.001$; dashed lines indicate non-significant path relations.

Table 2
Measurement model evaluation results.

Constructs	Measurement items	Loading	T statistics	Alpha	Composite reliability	AVE
Network Size	I think that many people use WeChat.	0.841	33.411	0.740	0.853	0.659
	I think that most people use WeChat.	0.770	19.612			
	I believe that many people will continue to use WeChat in the future.	0.822	28.289			
Number of Peers	I think many friends around me use WeChat.	0.834	31.355	0.719	0.842	0.641
	I think most of my friends are using WeChat.	0.825	27.397			
	I anticipate many friends will use WeChat in the future.	0.739	16.710			
Complementarity	A wide range of applications is available on WeChat.	0.687	12.766	0.693	0.813	0.521
	A wide range of supporting tools on WeChat (e.g. photo sharing and message sharing).	0.765	20.713			
	A wide range of news and information I can subscribe on WeChat.	0.719	13.638			
Compatibility	A wide range of games is available on WeChat.	0.714	17.666	0.728	0.830	0.552
	WeChat is well compatible with my Mobile devices.	0.753	24.769			
	WeChat is well compatible with the website I usually visit.	0.804	27.082			
Social Interaction Ties	WeChat is highly compatible with other social networking services.	0.770	25.286	0.751	0.858	0.668
	WeChat is highly compatible with other instant messaging applications (e.g., QQ).	0.635	11.307			
	I engage in a high level of interaction with friends using WeChat.	0.789	21.893			
Social Value	I spend considerable time interacting with friends on WeChat.	0.792	20.090	0.654	0.812	0.593
	I have frequent communication with friends using WeChat.	0.868	43.495			
	Sending information to others using WeChat can improve my image.	0.790	20.549			
Information Value	Sharing information with others using WeChat can improve relationships.	0.855	42.963	0.716	0.826	0.546
	I can know what are going on in my friends' lives via WeChat.	0.652	11.005			
	I accumulate numerous knowledge through WeChat users' shared information.	0.763	15.065			
Emotional Value	I acquire a variety of information from online people using WeChat.	0.617	10.427	0.764	0.864	0.680
	I obtain lots of useful information from online people using WeChat.	0.823	31.603			
	Over the last one month, I consulted online people using WeChat for practical issues and matters.	0.737	16.010			
Hedonic Value	I receive adequate emotional concern from people using WeChat.	0.805	26.883	0.752	0.858	0.669
	I feel relieved by getting sympathy from online people using WeChat.	0.837	29.857			
	I have been encouraged by friends on WeChat.	0.831	25.507			
Continuance Intention	I have fun interacting with WeChat.	0.770	24.280	0.751	0.843	0.574
	Using WeChat provides me with a lot of enjoyment.	0.838	30.808			
	I enjoy using WeChat.	0.844	35.749			
	If could, I will continue using WeChat.	0.792	23.381			
	I will recommend my friends and family members to use WeChat.	0.833	34.849			
	I will continue using WeChat in the future.	0.710	13.509			
	My intentions are to continue using WeChat service rather than any alternative.	0.686	10.919			

Boudreau, 2000). Likewise, all AVEs are higher than the critical threshold value of 0.50, providing support for the measures' convergent validity (Fornell & Larcker, 1981).

Finally, we assess the constructs' discriminant validity by the Fornell and Larcker (1981) criterion. As shown in Table 3, diagonal elements are larger than off-diagonal elements, showing that the square root of AVE of each construct is larger than the correlation coefficients between constructs. This proves that the constructs exhibit reasonable discriminant validity.

The measurement model assessment substantiates the reliability and validity of the constructs.

5.2. Structural model assessment

The proposed conceptual model shown in Fig. 1 was tested using structural equation modeling. The path coefficients are presented in Fig. 2.

The predictive power of the model was analyzed using the coefficient of determination (R^2). The R^2 of social interaction ties are 0.389, which indicates that the variance in social interaction ties is satisfactorily explained by direct and indirect network externalities. The R^2 of social value, information value, emotional value and hedonic value are respectively 0.435, 0.470, 0.504 and 0.395, all of which can be characterized as moderate to substantial. That is to say, the variance of perceived value is well accounted for by network externalities and social interaction ties. In addition, perceived value explains 57.8% of the variance of continuance intention.

The effects of direct network externalities ($\beta = 0.411$) and

indirect network externalities ($\beta = 0.290$) on social interaction ties are significant at $P < 0.001$, thus validating H1-1 and H1-2. Additionally, consistent with the conceptualization of direct and indirect network externalities as two formative second-order constructs, the sub-constructs of network size ($\beta = 0.532$) and number of peers ($\beta = 0.568$) are positively related to direct network externalities, and the sub-constructs of compatibility ($\beta = 0.557$) and complementarity ($\beta = 0.559$) significantly influence indirect network externalities, at $p < 0.001$.

Direct network externalities significantly influence social value ($\beta = 0.409$, $P < 0.001$), but the path coefficients of direct network externalities to information value ($\beta = -0.026$, ns), emotional value ($\beta = 0.107$, ns), and hedonic value ($\beta = 0.027$, ns) are not significant. Therefore, H2-1 is supported, but H2-2, H2-3, and H2-4 are refused. The indirect network externalities don't effect significantly on social value ($\beta = 0.108$, ns), but effect significantly on information value ($\beta = 0.487$), emotional value ($\beta = 0.258$), and hedonic value ($\beta = 0.334$) at $p < 0.001$, thus refusing H3-1, but validating H3-2, H3-3 and H3-4. However, the path coefficients of social interaction ties to social value ($\beta = 0.247$), information value ($\beta = 0.311$), emotional value ($\beta = 0.461$), and hedonic value ($\beta = 0.364$) are all considerably high and significant at $p < 0.001$, supporting H4-1, H4-2, H4-3 and H4-4.

Continuance intention is influenced by social value ($\beta = 0.344$, $p < 0.001$) and hedonic value ($\beta = 0.396$, $p < 0.001$), but the effect of information value ($\beta = 0.086$, ns) and emotional value ($\beta = 0.089$, ns) on continuance intention are not significant. Therefore, H5-1 and H5-4 are supported, and H5-2 and H5-3 are refused.

To further explore the relationship among network

Table 3
Discriminant validity assessment.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Network Size	0.812									
(2) Number of Peers	0.653	0.800								
(3) Complementarity	0.503	0.531	0.722							
(4) Compatibility	0.363	0.399	0.495	0.743						
(5) Social Interaction Ties	0.503	0.541	0.509	0.392	0.817					
(6) Emotional Value	0.404	0.533	0.570	0.388	0.658	0.824				
(7) Information Value	0.397	0.385	0.501	0.602	0.552	0.539	0.739			
(8) Hedonic Value	0.326	0.445	0.515	0.409	0.556	0.619	0.593	0.818		
(9) Social Value	0.532	0.576	0.496	0.315	0.540	0.491	0.435	0.511	0.770	
(10) Continuance Intention	0.472	0.626	0.600	0.469	0.506	0.550	0.519	0.678	0.627	0.758

Notes: Diagonal elements (bold) are the square root of average variance extracted (AVE) of each construct. Off-diagonal elements are correlation coefficients between constructs.

externalities, social interaction ties, and perceived value, we compute again the model after removing social interaction ties. The results shows that the path coefficients of direct network

externalities to social value ($\beta = 0.511$, $p < 0.001$), emotional value ($\beta = 0.298$, $p < 0.001$), and hedonic value ($\beta = 0.179$, $p < 0.05$) are all significant, except for the path coefficients of direct network

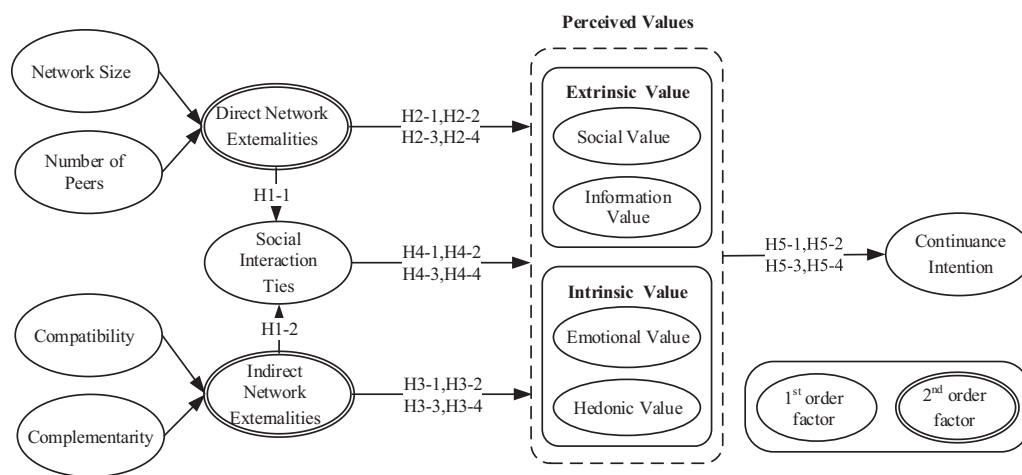
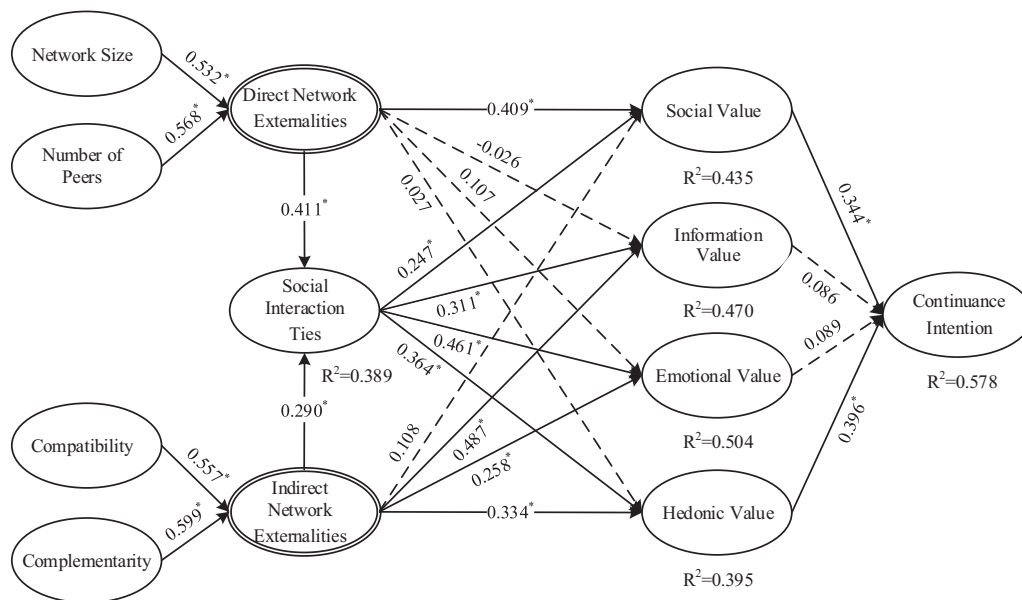


Fig. 1. Research model.



Notes: * $p < 0.001$; dashed lines indicate non-significant path relations

Fig. 2. Data analysis results.

externalities to information value ($\beta = 0.107$, ns); while, the path coefficients of indirect network externalities to information value ($\beta = 0.578$, $p < 0.001$), social value ($\beta = 0.178$, $p < 0.01$), emotional value ($\beta = 0.389$, $p < 0.001$), and hedonic value ($\beta = 0.438$, $p < 0.05$) are all significant. Comparatively, when the model contains social interaction ties, the effect of direct network externalities on emotional value and hedonic value become no longer significant, and the effect of indirect network externalities on social value is also no longer significant (see Fig. 2). We, hence, can infer that social interaction ties completely mediate both the effect of direct network externalities on emotional value and hedonic value, and the effect of indirect network externalities on social value; social interaction ties partially mediate both the effect of direct network externalities on social value, and the effect of indirect network externalities on information value, emotional value, and hedonic value; social interaction ties are requisite in the effect of direct network externalities on information value.

6. Discussion

This research investigates the mechanism of the effects of network externalities on social interaction ties, perceived values, and users' continuance intention to use WeChat.

6.1. Summary of findings

The research results have validated that our model has a good explanatory power in predicting WeChat users' continuance intention.

6.1.1. Influence of network externalities on perceived values

Direct network externalities have significant direct effects only on social value but not on information value, emotional value, or hedonic value. This finding implies that the awareness of the achievability of the peers of users through WeChat can increase perceived social value. However, information value, emotional value, and hedonic value are highly dependent on the content that people can indeed interact with. Exclusively direct network externalities involving no actual interaction cannot guarantee any of these values.

By contrast, indirect network externalities significantly affect information value, emotional value, and hedonic value but not social value. This conclusion implies that high indirect externality guarantees the resources of information value, emotional value, or hedonic value to users. When the auxiliary services are used or consumed alone, they are not helpful in realizing social value. WeChat is developed to benefit communication between people. When social interaction is absent, WeChat definitely does not have the advantage of professional games, news, and story providers.

In summary, this conclusion, which excludes the effect of social interaction ties, indicates the clear-cut influence of network externalities on different types of perceived values.

6.1.2. Mediating role of social interaction ties

Our findings have confirmed the mediating role of social interaction ties in the effect of network externalities on perceived values. In particular, through social interaction ties, direct network externalities strengthen their influence on social values by providing the online convenience, which is experienced in person. In addition, through social interaction ties, direct network externalities positively influence information value, emotional value, and hedonic value, indicating the benefits from social interactivities online.

Meanwhile, through social interaction ties, indirect network externalities can influence users' perceived social value. We can

infer that the auxiliary functions (such as information from other websites or social media and entertainment services) are used for interpersonal interaction and for shaping collective experiences to enhance the perceived social value. Again, through social interaction ties, the information value, emotional value, and hedonic value increases, thereby suggesting the benefit of interactions.

Prior research stressed on the effect of social interaction ties on trust and commitment (Lin & Lu, 2011b; Wang & Chen, 2012), whereas our research focuses on the consequences of social interaction ties on the perceived values in WeChat, which serves people who are physically connected offline instead of strangers.

6.1.3. Effect of perceived values on continuance intention

Among the four types of perceived values, only social value and hedonic value have significant positive effects on users' continuance intention. We can infer that WeChat users do not aim for solutions to particular problems or emotional relief but for connections to people, fun, and pleasure. Furthermore, hedonic value has a greater effect on users' continuance intention to use than social value. Compared with other social networks where people join in for the same interests and expertise, WeChat seems to be more like an online personal realm duplicated from casual daily lives. People only log in for fun and to have a look at the things that their peers say and show, without having a clear goal for particular information or emotional comfort. WeChat does not have an overwhelming advantage in providing information over newspapers, TV shows, and websites. The social relationship that is loosely knitted online is not strong enough for effective emotional support. Although technology can mediate communication, it is not expected to replace a person as an emotional comfort provider. People who are physically connected offline may resort to another immediate method for emotional support.

Overall, the specified dimensions of perceived values, instead of the approximate categories in the previous literature (Al-Debei et al., 2013; Lin & Bhattacharjee, 2008; Lin & Lu, 2011a; Zhou & Lu, 2011), provide insight into services positioning for WeChat managers.

6.2. Theoretical implications

WeChat should not be considered simply as a communication tool or a phone but an artificial structural equivalence of social connections that carries a user's social capital. Users join and immerse into SNS, which by nature is the start of the transference of their social capital to online, and digitalize their daily lives against the limitation of time and space. In terms of the connection of virtual space and the offline world, our research can partially explain why people join in an SNS platform and why they repeatedly use it.

First, the four dimensions of WeChat users' perceived values (social value, information value, emotional value, and hedonic value) are verified. Previous research simply dichotomized SNSs' perceived values into perceived usefulness (sometimes called as information value, referring to benefit from advice, guidance, and suggestions; Taylor, 2011; Lin & Lu, 2011b; Zhou & Lu, 2011; Lin & Bhattacharjee, 2008) and enjoyment (also called hedonic value; Lin & Lu, 2011b; Zhou & Lu, 2011; Lin & Bhattacharjee, 2008), ignoring the diversified values, including social value (e.g., companionship or verbal reinforcement about one's choices; Hirsch, 1980; Cutrona & Suhr, 1992; Lin & Bhattacharjee, 2009; Lin, 2011) and emotional value (e.g., expressions of care, concern, affection, and sympathy; Lin, 2011; Taylor, 2011).

Second, our research empirically proved different functional mechanisms of the effects of the network externalities on the four types of perceived values by analyzing and addressing the role of

social interaction ties as a mediator in these effects. Prior studies have well documented the effect of externalities on perceived values (Al-Debei et al., 2013; Lin & Bhattacharjee, 2008; Lin & Lu, 2011b; Zhou & Lu, 2011), but none of them discussed the mediating role of social interaction ties in this effect. The rule settings of WeChat, particularly news and information exclusively from friends on the contact list, make the social interaction ties pivotal and determine the discrepancy between the benefits that one can actually gain by using WeChat and those that one expects to gain. Without social interaction ties, which appear as “mutual friends” online, the influence of network externalities is dramatically weakened.

Third, we discovered that the four types of perceived value in WeChat have unequal effects on users' continuance intention, providing insight to weight influential factors differently. Previous research indicates that information value and hedonic value can positively influence continuance intention to use SNSs (e.g., Lin & Bhattacharjee, 2008; Lin & Lu, 2011b). For WeChat, information value and emotional value have no static, significant effect on continuance intention. This conclusion confirmed the difference of WeChat and other SNSs of shared expertise and interests. The pursuit of fun, pleasure, and a sense of companionship, instead of information value or emotional value, is WeChat users' priority motivations. The discovery is based on specified types of perceived values and highlights the diverse focuses of service portfolio in improving users' continuance intention to use.

6.3. Practical implications

Continuance intention has become increasingly vital in the intense competition among SNS providers. According to our conclusion, WeChat managers can enhance users' continuance intention by enhancing network externality, increasing social interactivity ties, and particularly improving the social value and hedonic value. These rules also provide implications for other SNS providers.

Considering the effect of network externalities on perceived values, WeChat managers must extend the network externalities to increase perceived values. For example, WeChat providers can cooperate with cellphone producers to install WeChat software as a default program, attract users by providing e-coupons, and integrate more access to relevant content providers.

The mediating role of social interaction ties indicated that the core competence of WeChat is fundamentally determined by the time that users would like to invest in maintaining their social capital using this platform. When WeChat has become a solidified path to users' social capital, other competitors will find difficulty in defeating WeChat's status. WeChat managers must help users in transferring their social capital to the WeChat platform and activating people to interact. In addition to the regular interactions, such as notifications, thumbs-ups, and comments, more designs based on thematic events can be created as interaction opportunities, such as creating an anniversary report to visualize one's personal interactivities with other WeChat members. To enhance social interaction ties, WeChat launched the Red Envelope function in January 2014 to transact virtual money with WeChat friends and withdraw cash from one's account. The Chinese celebrate Spring Festival by putting money in a red envelope as a gift to family and friends. During the 2015 Spring Festival, WeChat invited users to shake their smartphones for a chance to win red envelopes with a total of \$83 million provided by WeChat. Catering to the celebration of this tradition, WeChat also encourages people to send a Red Envelope to a group of friends, who have chances to win a random amount of money. This promotional campaign dramatically increased the social interaction ties between users and opened a

high-potential payment market.

6.4. Limitations and future study

SNS managers prefer that users transfer their social capital from offline to online, but the potential backfire of social capitals from offline should not be overlooked. Upsurges of contacts on WeChat make restricting the information to spread exclusively within a certain group increasingly difficult. To avoid the negative effects of privacy deprivation, some users have quit updating their Moments. They did not use WeChat quite often, and they became salient and inactive. Further exploration of user experiences and reactions in different stages would support pertinent strategies to improve users' engagement.

In addition, under social pressures, people may feel obligated to receive messages from acquaintances, although they do not enjoy these messages. People may take their peers' reaction into consideration before giving thumbs-ups and comments and show different behavioral patterns from those in the general public scenario. Future research can investigate users' behavioral pattern under social pressure.

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