Information Systems Frontiers (2020) 22:149–170
https://doi.org/10.1007/s10796-018-9852-9

Examining the Role of Tie Strength in Users' Continuance Intention of Second-Generation Mobile Instant Messaging Services

Xiuyuan Gong[1] · Matthew K. O. Lee[2] · Zhiying Liu[1] · Xiabing Zheng[1]

Published online: 23 April 2018

Abstract
Second-generation mobile instant messaging (SMIM) is a new structure of social media facilitated by the widespread use of smartphones. It is embedded in social networks and support fundamental functions. However, tie strength, as a social network configuration, is ignored in existing SMIM studies. The present work incorporates the effect of tie strength into expectation-confirmation model, proposing the continuance intention model in the unique context of SMIM and investigating the potential driving forces (i.e., users' satisfaction, tie strength, confirmation of values, and perceived critical mass). Results show that tie strength appears to be a negative moderating force between satisfaction and continuance intention in SMIM services and arises from the confirmation of social value. In particular, the confirmation of sense of belonging has the strongest association with tie strength enhancement, while the confirmation of self-expression is the most important driver of satisfaction. Both satisfaction and perceived critical mass directly contribute to continuance intention of SMIM users, and perceived critical mass has a stronger impact.

Keywords Tie strength · Social media · Expectation-confirmation model · Continuance intention · Second-generation mobile instant messaging

1 Introduction

Recent advancements in the digital world have drastically changed our daily lives and the way we live. Unlike desktop-based services, mobile-based services have developed in an unprecedented way. For instance, ComScore (2015) revealed that the growth of mobile applications (apps) exploded rapidly in the U.S. market in 2014. The mobile avenue of Facebook surpassed its desktop revenue, thereby indicating that mobile apps have become the primary digital media platform. Second-generation mobile instant messaging (SMIM), such as WeChat, is a real-time communication tool of mobile devices that is able to offer multimedia services and is embedded within social networks under wireless connections. Compared with other apps (e.g., Sina Weibo or Twitter) that are aimed to information sharing or seeking, SMIM is prominent for its interaction-oriented functions. Moreover, SMIM services are becoming increasingly popular because of the penetration of smartphone use (Deloitte 2014). Although the potential market for SMIM services is large, SMIM service providers are under tremendous competitive pressure from other social media platforms. In January 2015, WeChat became the most active social media platform in China. However, the number of active users of WeChat in China surpassed that of Sina Weibo by only 5%, while the number of active users of Twitter in Japan exceeded that of Line by 13% and dominated the Japanese market (WeAreSocial 2015).

Recently, mobile instant messaging (MIM) has developed gradually from first-generation mobile instant messaging (FMIM) to SMIM. Unlike FMIM services such as short message service, SMIM services offer additional functions. First of all, SMIM is able to exchange messages without having to pay it and produce a lot more messages with SMIM when compared with short message service (SMS) (Church and de Oliveira 2013). In addition to text-based communication

✉ Xiabing Zheng
is.xzheng@gmail.com

Xiuyuan Gong
gxysusan@mail.ustc.edu.cn

Matthew K. O. Lee
ismatlee@cityu.edu.hk

Zhiying Liu
liuzhiyustc@163.com

[1] School of Management, University of Science and Technology of China, Hefei, China

[2] Department of Information Systems, City University of Hong Kong, Hong Kong, China

functions, SMIM services enable users to create multimedia (e.g., audio and pictures) and hypermedia (e.g., links and tags) content (Kane et al. 2014) and interchange quick-fire responses (Deloitte 2014). More importantly, SMIM services are embedded within social networks. Social influence has greater influence in the adoption and diffusion of SMIM rather than SMS (Church and de Oliveira 2013). Also, SMIM allows users to notice the status of their friends (Meng et al. 2012), such as online, offline, free, or busy. By paying attention to the thoughts or ideas posted on the personal blogs of their friends, SMIM users are able to maintain personal connections with their close friends or develop a sense of belonging in specific social networks. Instead, SMS is primarily used as a means of formal communication (Church and de Oliveira 2013).

However, previous studies on the post-adoption behavior of SMIM have mainly approached issues from certain individual perspectives of users, such as perceived service quality, trust, switching cost, and flow experience (Deng et al. 2010 ; Zhou and Lu 2011). A few scholars have started to explore the effect of social networks on continuance usage behavior from the network externality perspective (Zhou and Lu 2011), but they have tended to neglect the social network perspective which is fundamental to SMIM (as compared with FMIM). Apart from network externalities, tie strength is also one of the most pertinent social network parameters in this context. Tie strength represents the intensity or intimacy of relationships between users in social media (Gilbert and Karahalios 2009). It is a prevalent but often neglected feature in social networks research, thereby making the study of its effect in particular on mobile social media networks a highly appealing subject (Kane et al. 2014). Specifically, tie strength is found to affect several crucial outcome variables, such as career advancement, word-of-mouth propagation, and inter-group conflict (Mittal et al. 2008). It seems clear that tie strength has a general impact on behavior outcomes (or intention) in a social network context and may extend to the continuance use of social network platform services such as those provided by SMIM. Therefore, the potential effect of tie strength on continuance intention in the SMIM context is worth exploring. Drawing on expectation–confirmation model (ECM), this study explores the effect of tie strength on the continuance intention of SMIM users, and investigates the interaction between tie strength and other factors (i.e., satisfaction, confirmation of values, and perceived critical mass) that influence continuance intention.

This study is structured as follows. First, it provides a review of relevant literature and an overview of the theoretical background, followed by the proposed research model and hypotheses. Thereafter, it describes the research methodology and presents the discussion of the results and implications. Finally, it points out the limitations and states the conclusions.

2 Literature Review and Theoretical Background

2.1 Mobile-Based Services Adoption and Diffusion

Researchers have paid much attention on information systems (IS) adoption and diffusion. They often used traditional models such as unified theory of acceptance and use of technology (UTAUT), IS success model, technology acceptance model (TAM), and theory of planned behavior (TPB) as the basis of their research, exploring whether the models' theoretical constructs are likely to affect user adoption of an information system, or investigating whether consumer will use an information system based on the assumed factors. For instance, drawing upon a revised UTAUT, scholars demonstrated that attitude is central to user IS adoption intention and usage behaviors (Dwivedi et al. 2017 ; Rana et al. 2017). Attitude is further determined by social influence, performance expectancy, effort expectancy, facilitating conditions, or anxiety. Gao and Waechter (2017) explored adoption of e-government with IS success model and noted that the perceived quality would affect usage intention through initial trust, perceived usefulness, or perceived ease of use. Based on an extended TAM, Sharma (2017) reported that trust and autonomous motivation were the two main predictors influencing mobile banking acceptance.

In addition, scholars may take using intention or usage as a dependent variable, and explore the determinants of IS adoption and diffusion. By using meta-analysis, Rana et al. (2015a) explored the determinants of e-government adoption. The most frequently used determinants include subjective norm, perceived behavioral control, personal innovativeness, facilitating condition resources, followed by attitude, trust, performance expectancy, social influence, perceived usefulness. Similarly, Dwivedi et al. (2015) also reviewed IS literature and reported the determinants of IS success and IS failures. Moreover, satisfaction is also found to be a critical factor that affects user continuance usage intention which in turn affects the extent of service usage (Lai 2004). IS users' satisfaction is usually influenced by perceived value, emotional enjoyment, service quality, information quality, system quality, users' personality traits and so on (Nguyen et al. 2017; Rana et al. 2015b; Xu et al. 2010; Yoon and Suh 2004).

For mobile-based services, Kim and Hwang (2012) examined users' perception of mobile Internet service quality from a value tendency perspective and demonstrated that the perception of service quality was greatly influenced by utilitarian and hedonic value tendency. Similarly, Lai (2004) noted that perceived value was a determinant of customer satisfaction, which would affect their behavioral intention to continue to use SMS. Hong et al. (2008) reported that attitude, social influence, media influence, perceived mobility, and perceived monetary value positively affected continuance usage

intention of mobile data services such as mobile chatting, multimedia message service, and SMS. Moreover, Kapoor et al. (2015) compared the predictive capacity of three sets of innovation attributes on the adoption and diffusion of interbank mobile payment service in India, and reported key factors predicting behavior intention such as relative advantage, compatibility, social approval, communicability, voluntariness. Shareef et al. (2016) studied mobile-government system by taking cultural traits into consideration, and found that perceived enjoyment affected perceived compatibility, which in turn affected user intention toward the system.

However, the prior studies overlooked the role of tie strength in users' adoption and continuance usage intention of SMIM. Due to the communication nature of SMIM, social ties appear to be important to user perception and continuance intention of SMIM services such as WeChat (Zhang et al. 2017; Zheng et al. 2017). Besides, ECM is found to be effective in understanding the adoption and diffusion of mobile-based services (Hong et al. 2006; Kim 2010). Nevertheless, less research effort has been devoted to extend ECM with tie strength and examine the effect of tie strength on SMIM usage intention. As such, more research is required to explore the role of tie strength, along with ECM, in affecting user continuance intention in the SMIM context.

2.2 Expectation–Confirmation Model (ECM)

ECM is an adaptation of expectation-confirmation theory (ECT) from Oliver (1980), which has been widely used in marketing discipline to examine the effect of customer satisfaction on customers' repurchase intention. In ECT, satisfaction is affected by confirmation, which is determined by comparing product/service performance and customers' expectation. However, ECT has limitations to explain users' continuance intention of IS. For instance, it cannot fully explain the IS expectation formation process and the notion of end-user satisfaction of IS systems, and it deals with customers in marketing rather than consumers of an IS (Hossain and Quaddus 2012). Due to the congruence between IS consumer continuance decision and customer repurchase decision, Bhattacherjee (2001b) proposed the ECM of IS continuance. Compared to ECT, ECM has unique features to explain the users' continued use of IS (Bhattacherjee 2001b; Hossain and Quaddus 2012). Firstly, it highlights the importance of post-acceptance variables rather than pre-acceptance variables (e.g., pre-acceptance expectation in ECT). Secondly, perceived usefulness is the surrogate for post-acceptance expectation in ECM, and perceived usefulness is the belief that expected to consistently influence user intention across temporal stages of IS use. Moreover, the influence of performance is already explained by the confirmation variable. It is also suggested that the influence of performance is mediated by confirmation (Thong et al. 2006; Yi 1990). In ECM, confirmation and satisfaction have captured the effects of any pre-acceptance variables (Bhattacherjee 2001b).

ECM posits that three variables are of importance to users' intention to continue IS usage: users' satisfaction with the IS, the confirmation of users' post-acceptance expectations, and post-acceptance perceived usefulness of the IS (see Fig. 1). The hypotheses in ECM are as follows: Firstly, IS users' continuance intention is directly determined by users' satisfaction and users' perceived usefulness of IS. Moreover, both users' satisfaction and users' perceived usefulness of IS are influenced by the confirmation of users' expectations. During these processes, the confirmation of expectations suggests that the realization of users' expected benefits of IS use through usage experiences will leads to a positive effect on users' satisfaction with IS. Also, the perceived usefulness of IS will be adjusted as a result of confirmation experience, particularly when users' initial perceived usefulness is not concrete. This relationship is supported by the cognitive dissonance theory (Festinger 1957), which proposes that users may suffer from cognitive dissonance or psychological tension when their pre-acceptance usefulness perceptions are disconfirmed during actual use. Lastly, users' perceived usefulness of IS also positively influences users' satisfaction.

However, the effect of perceived usefulness on user satisfaction and IS continuance has been questioned by scholars. Although Bhattacherjee (2001b) verified ECM through an empirical study, the results indicated that perceived usefulness had a weaker effect on satisfaction and IS continuance intention, comparing to the strong effect of confirmation. In 2008, Bhattacherjee had dropped the direct association between post-usage perceived usefulness and satisfaction from the ECM (Bhattacherjee et al. 2008). In the following ECM-based research, Jin et al. (2010) only took satisfaction and confirmation as the critical antecedents and explored IS continuance in online contexts such as online community, regardless of the effect of perceived usefulness. Other empirical evidence also shows that little support for the direct and significant effect of performance beliefs such as post-usage usefulness on IS continuance intention, while confirmation is a strongest effect on satisfaction and a necessary component of predicting system continuance (Lowry et al. 2015). Bhattacherjee and Premkumar (2004) and Xu et al. (2017) posited that continuance/discontinuance decisions that were mainly determined by disconfirmation of expectations. Thus, we mainly focus on the impacts of confirmation of values and satisfaction on IS continuance in the context of SMIM.

This study chooses ECM as the theoretical apparatus for the following reasons. Firstly, ECM is proved to be helpful to investigate IS post-acceptance behavior and is widely used in various online contexts, such as virtual communities, electronic commerce services, World Wide Web use, and web-based learning programs (Bhattacherjee 2001a; Hsu et al. 2004 ; Jin

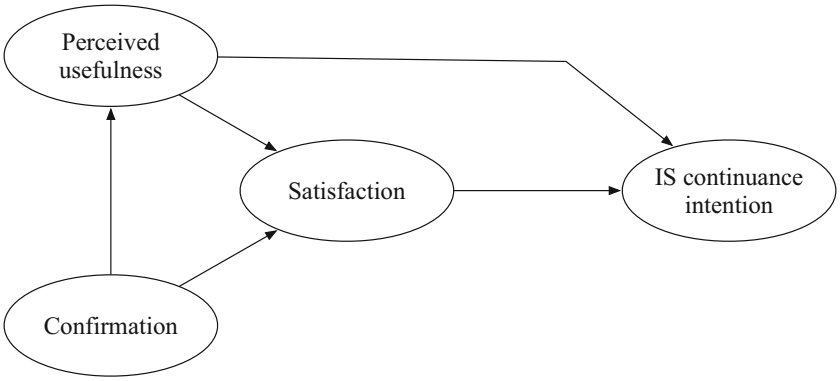

Fig. 1 Expectation-confirmation model (Bhattacherjee 2001b)

et al. 2010; Lee 2010 ; Vatanasombut et al. 2008). Secondly, the development of ECM has received considerable attention from IS researchers. In recent years, scholars still work for improving ECM from the methodological and analytical perspectives (Brown et al. 2012, 2014; Venkatesh and Goyal 2010). More importantly, ECM has been adopted to understand the continuous use of mobile Internet services or mobile data services (Hong et al. 2006; Kim 2010), indicating its capability to explain or predict continuance use in the mobile context. However, ECM also has limitations to explain IS continuance in the contexts that are comprised of interpersonal social interactions. For instance, Jin et al. (2010) found that ECM was insufficient to explain users' continuous use intention of online social community. To solve this problem, they integrated a social factor (i.e., affective commitment in their study) in research model to explain the effect of social feature on continually use of the online community. This method is widely accepted by many mobile Internet studies using ECM to explain users' continuance intention in their research contexts (Hong et al. 2006 ; Thong et al. 2006). Compared with other social media such as online community or microblog, SMIM such as WeChat is filled with strong ties (CNNIC 2016 ; Gong et al. 2015). Therefore, we integrate tie strength as an important social feature to explain users' continuance intention in the SMIM context.

2.3 Tie Strength

Tie strength was first proposed by Granovetter (1973) in sociological research and was categorized as either strong or weak, which represent two types of relationships with different degrees of ties. Strong ties represent people's relationships with others they trust and whose social circle overlaps with theirs, such as good friends or relatives, while weak ties are ties between strangers or acquaintances. This work is regarded as the benchmark of tie strength research. Gradually, the focus of tie strength research was developed gradually, and received substantial attention from scholars in different research areas (see Table 1). The present study describes tie strength in the SMIM context as the intensity of the relationships between users in a social network existing in SMIM services.

Tie strength is found to affect various outcomes in different contexts, but few studies have explored the effect of tie strength on continuance intention in the SMIM context. Most existing works argued that tie strength has an effect on customer complaint in the work context (Mittal et al. 2008), loyalty intention in contractual relationships (Woisetschläger et al. 2011), and students' decision to choose a professor in online word-of-mouth forums (Steffes and Burgee 2009). Scholars may also combine two of the network configuration dimensions (i.e., tie strength, structural holes, and network centrality) and investigate their effects (Seibert et al. 2001).

The present study integrates tie strength into ECM instead of network centrality or structural holes because of the following concerns. The first concern refers to the number of contacts resulting from egos in the central position or in structural holes. Scholars have found that increasing the contacts of people does not always result in positive outcomes (Lee and Kim 2011). The limited energy of individuals may result in an unbalanced relationship between strong ties and weak ties (Seibert et al. 2001). SMIM users can reduce unnecessary contacts and focus on their friends with whom they share strong ties in the SMIM service. This scenario creates opportunities for an efficient relationship management. The second concern refers to the position issue. In reality, users who are not the central member of groups may still have a great propensity to stay in an SMIM service because strong ties exist in social media (Gilbert and Karahalios 2009). In addition, researchers have found that tie strength, rather than individual centrality, has more significant effects on users' intention to stay in a virtual community (Hsiao and Chiou 2012). On the basis of the above discussion, this study chooses tie strength and examines its effect on the continuance intention of SMIM users.

2.4 Perceived Critical Mass (PCM)

This study aims to offer a systematic way of understanding and conceptualizing online social media as an ecosystem of

Table 1 Summary of previous research on tie strength.

Analysis	Scope	Main contributions	Authors
Concept of tie strength	Definition of tie strength	It first defined tie strength as "a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie."	Granovetter (1973)
	Types of tie strength	It classified tie strength as either strong or weak and claimed that the degree of overlap of the personal networks of two individuals varies directly with the strength of their ties to each other.	
Measurement of tie strength	Aspects, indicators, and predictors of tie strength	It pointed out two distinct aspects of tie strength, namely, "time spent in a relationship" and "the depth of the relationship." It also argued that closeness or intensity is the best indicator of tie strength, whereas frequency and duration of contacts are difficult to be the indicators of tie strength. Thereafter, it considered that predictors, including kinship or neighboring, are not strongly related to tie strength.	Marsden and Campbell (1984)
	Crucial elements for the prediction of tie strength	It identified the predictive variables of tie strength, including intimacy, intensity, duration, social distance, services, emotional support, and structural variables (predictive power ranges from strong to weak).	Gilbert and Karahalios (2009)
	Prediction of tie strength	It was a comprehensive study on the effects of using data mining techniques to predict tie strength. These techniques include basic classification methods (e.g., decision trees and Naive Bayes) and ensemble methods (e.g., Bagging and Boosting methods).	Sohrabi and Akbari (2016)
Context of tie strength	Tie strength in the offline context	It defined offline tie strength as "the intensity of a social relation between pairs of individuals."	Brown et al. (2007)
	Tie strength in the online context	It defined online tie strength as "the intensity of an interactive and personalized relationship between an individual and a Web site."	
Application of tie strength	Tie strength as an independent variable	It clarified that tie strength, strong ties in particular, was a causal driver of networks' information benefits. Strong ties were more likely to actually transmit information.	Kim and Fernandez (2017)
	Tie strength as a dependent variable	It focused the formation of tie strength between first-time strategic alliance partners. It claimed that interorganizational learning, partners' communication, and project characteristics determined the formation of tie strength. These relationships were moderated by the partners' market overlap and the partners' technical skills, respectively.	Badir and O'Connor (2015)
	Tie strength as a moderating variable	It supported that tie strength moderated the extent to which the media use violation was perceived as important.	Taylor and Ledbetter (2017)
	Tie strength as a mediating variable	It found that tie strength, strong ties in particular, attenuated the influence of network redundancy on the probability of information diffusion.	Liang and Fu (2016)

related elements involving both internal interpersonal relationship and external social influence. In this study, we take the PCM as the external social influence.

PCM is considered as an important component of social influence that affects individuals' attitude (Hsu and Lu 2004) and behavioral intention in interactive technologies such as groupware applications (Lou et al. 2000) or instant messaging applications (Van Slyke et al. 2007). SMIM services, as an interactive communication technology, have the great potentials for users to develop the perception of critical mass. In this study, we claim that PCM can be developed in the SMIM services and that it exerts a direct effect on the continuance intention of SMIM users that are seldom investigated before (Zhao and Lu 2012).

3 Research Model and Hypotheses

The research model is provided in Fig. 2, which presents a brief view of SMIM users' continuance intention influenced by satisfaction and tie strength, as well as PCM. Tie strength plays a moderating effect on the relationship between satisfaction and continuance intention. Satisfaction is influenced by the confirmation of perceived values, including social value,

hedonic value, and utilitarian value. The following section illustrates the hypotheses of the research model.

3.1 Expectation–Confirmation Model in SMIM Services

Drawing upon ECM (Bhattacherjee 2001b), this study predicts satisfaction to be an essential determinant of the continuance intention of users. In the SMIM context, SMIM services seek to improve user satisfaction by providing multiple functions that enable users to conduct various activities. For instance, by using an SMIM service, users can access diverse resources and communicate in real-time with friends (e.g., chatting by sending a message or making a call) through free SMIM apps. When users are satisfied with their previous use of a service, they are more likely to have a higher use level of a service than dissatisfied users (Cheung and Lee 2009). Following this logic, we propose that the continuance intention of SMIM users is determined by their satisfaction toward their prior use of a certain SMIM service.

> **H1:** The continuance intention of users to use an SMIM service is positively related to their satisfaction with the service.

Bhattacherjee (2001b) argued that the confirmation of expectations was crucial in influencing users' satisfaction. When the performance of a service meets or exceeds expectations, a consumer was satisfied. When the performance of a service fails to meet expectations, a consumer is dissatisfied. Specifically, Jin et al. (2010) argued that the confirmation of expectations could be regarded as the realization of users' expected values. Researchers often classified reasons for continued use into three categories of values: utilitarian value (Liang et al. 2011), hedonic value (Zhou and Lu 2011), and social value (Chen et al. 2013). They also identified values from self-referent and group-referent perspectives (Cheung and Lee 2009; Dholakia et al. 2004). The context of SMIM services is similar to the context of virtual communities. According to previous studies and the specific context of SMIM services, this study supposes that users' satisfaction with an SMIM service can be determined by the confirmation of utilitarian value (purposive value and self-expression), hedonic value (entertainment value), and social value (maintaining interpersonal interconnectivity and sense of belonging). The definitions of these values in the context of SMIM services are provided in Table 2.

From the self-referent perspective, utilitarian value such as purposive value are the most important value that people want to fulfill, and they are task-oriented and determined in advance (Jin et al. 2010). In other words, users have specific end-state goals in mind before using a particular technology (Cheung and Lee 2009). In general, users conduct intended or anticipated purposive actions that always lead to relatively desirable outcomes (Merton 1936). Ultimately, utilitarian value such as purposive value can be gratified by task completion (Babin et al. 1994).

Compared with objective purposive value (Jin et al. 2010), self-expression value is more subjective. Self-expression indicates the desire for people to express themselves. The youth is more likely to seek opportunities to express themselves, in order to distinguish who they are and what they are about (Arthur et al. 2006). This need for users to talk and to be listened may result from their desires to present their capability to obtain others' attention (Cao et al. 2013). In particular, people are more likely to express themselves in online context (Tidwell and Walther 2002). Therefore, SMIM services offer opportunities for users to fulfill this need. They can use blog or group features in SMIM services as an outlet for personal expression or reflection (Huffaker 2006). According to ECM (Bhattacherjee 2001b), we propose the following:

> **H2:** User satisfaction is positively related to the extent user expectation on (a) purposive value and (b) self-expression of the SMIM service is met.

Another crucial factor that people want to fulfill in Internet usage is entertainment value, which is often viewed as the hedonic motivation for Internet usage (Jin et al. 2010). Young consumers especially need and ache for on-demand entertainment because of the technology-induced acceleration environment (Arthur et al. 2006). Compared with utilitarian counterparts, entertainment value is often considered from the experimental perspective and is thus typically gratified by the activity itself (Jin et al. 2010). For instance, people can develop a pleasurable feeling and enjoy their leisure time when they use a service (Cheung and Lee 2009). In SMIM services, users can actively chat with their peers or play mobile games, or they can passively utilize the recommendations of their peers to gain insights into things that could potentially appeal to them. Thus, we propose the following:

> **H3:** User satisfaction is positively related to the extent user expectation on the entertainment value of the SMIM service is met.

From the group-referent perspective, maintaining interpersonal interconnectivity (Dholakia et al. 2004) and seeking emotional support (Cao et al. 2013) denote the desires of people to identify themselves as part of a group and align their goals with other members of the group.

Interpersonal connectivity has been considered as a resource (Van Dijck 2013). From this perspective, maintaining interpersonal interconnectivity can be a way for users to build their social networks (i.e., a huge resource pool) in social media platforms (Ang 2011). In terms of facilitating relationship

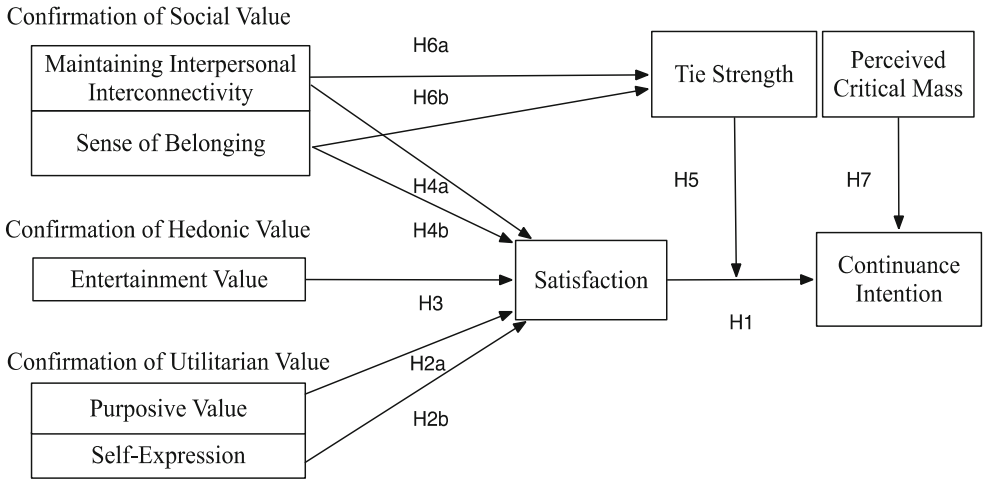

Fig. 2 Proposed research model

maintenance and development, instant messaging is found to be more preferable than Facebook, e-mail, and telephone (Quan-Haase and Young 2010). First, SMIM services are often used to establish connection with close friends or family members, and they especially support family connectedness (Williams and Merten 2011). Second, with the regard to relationship maintenance, instant messaging prevents users from missing significant moments in the lives of other users, and it allows them to take part in the everyday decisions of their contacts (Arthur et al. 2006). Establishing associations enable users to converse, share objects of sociality, meet up, or list others as a friend, which therefore relate two or more users (Kietzmann et al. 2011).

The need to belong, or emotional belonging, is a fundamental human motivation (Baumeister and Leary 1995), which also exists in the social technology context (Rau et al. 2008). Sense of belonging represents a subjective sense of affiliation and identification (Hoffman et al. 2002) and is defined as the experience of personal involvement in a system or an environment (Hagerty et al. 1992). Users' identification may results in emotional attachment, which positively influence users' SMIM use (Wu et al. 2017). It promotes individuals to perceive intimacy in a group and develops better interpersonal relationship with others. Thus, sense of belonging is regarded as a crucial factor that contributes to individual retention decision (Hoffman et al. 2002). With the help of advanced technologies, the resulting cooperative, noncommercial, peer-produced system can serve individuals' communicative and creative needs through networks of like-minded peers (Van Dijck 2013). Under this circumstance, intimacy

Table 2 Definitions of values in SMIM services.

Constructs	Definitions
Purposive Value (PV)	Purposive value refers to the value that improves the efficiency of realizing users' specific purposes. *For instance, if a boy's purpose is to know the preference of a friend, he could get the information from the posts or comments of the friend in WeChat.*
Self-expression (SE)	Self-expression refers to people sharing information about their thoughts or daily lives in their own space, indicating their competence or trustworthiness to obtain others' attractiveness. *For instance, a girl may post in WeChat: "I found an amazing book in library", in order to show her capability to find an amazing book and to obtain others' attention.*
Entertainment Value (EV)	Entertainment value refers to the value drawn from relaxing and funny perceptions. *For instance, when a person is tired of working, he/she can be relaxed by browsing others' discussion in groups or Moments, or by finding interesting content in official accounts (subscription accounts).*
Maintaining Interpersonal Interconnectivity (MII)	Maintaining interpersonal interconnectivity refers to the social benefits derived from establishing and maintaining contact with other users. *For instance, people can use WeChat to reconnect and stay in touch with users (old friends or someone in remote countries) that cannot access elsewhere.*
Sense of Belonging (SOB)	Sense of belonging refers to the value derived from a sense of emotional involvement with a group. *For instance, users can talk to friends through WeChat when they are lonely, they can also express their problems in WeChat's groups and seek for help.*

and engagement are easy to be propagated in social media (Hanna et al. 2011). Thus, this study proposes that:

> **H4:** User satisfaction is positively related to the extent user expectation on (a) maintaining interpersonal interconnectivity and (b) a sense of belonging of the SMIM service is met.

3.2 Moderating Role of Tie Strength

Several researchers conceived satisfaction to be an important factor in continuance usage studies. However, the satisfaction–continuance intention link has been equivocal, and some studies have noted the insufficient explanatory power of satisfaction with regard to continuance behavior such as repeat purchase. For instance, Jones (1996) argued that satisfied customers might also defect. The initial basic services may be helpful to acquire clients, but the support services such as ease of interaction are critical for clients' maintenance. The empirical studies from Skogland and Siguaw (2004) also found the insignificant effect of overall satisfaction on repeat purchase and they claimed that switching cost played a role in influencing customer loyalty aside from satisfaction. This argument is consistent with Khatibi et al. (2002) and Mittal and Lassar (1998), indicating that even if high levels of customer satisfaction existed, customers still possessed a strong predisposition to switch service suppliers. In sum, previous research has inconsistent conclusions with regard to the effect of satisfaction on continuance intention. It seems clear that the effect of satisfaction on continuance intention is not a simple clear-cut one, and other factors may be at play. We argue that the missing consideration is the social factors such as tie strength, which plays the role as a moderator in the link between users' satisfaction and their continuance intention.

When scholars consider the role of tie strength, most of them may focus on the effect of weak ties (Levin and Cross 2004 ; Seibert et al. 2001). However, strong ties also have values (Granovetter 1983). For instance, strong ties are more likely to transmit information (Kim and Fernandez 2017), thus information received from strong ties is more valuable and has more benefits for job seekers. In social networking services (SNSs) such as Twitter, strong ties can attenuate the influence of network redundancy on the probability of being retweeted (Liang and Fu 2016). In mobile communication context, Onnela et al. (2007) confirmed that strong ties could be found in a tightly connected networks. Following this logic, SMIM services such as WeChat should have a great number of strong ties, which is also supported by CNNIC (2016). In terms of the moderating effect of tie strength, empirical evidence has found that tie strength moderated the relationship between network content and decision-making time (Perry-Smith 2014). When receiving content from strong ties, individuals exposed to nonredundant frames will spend more time thinking about their decision. Tang et al. (2016) found that the effect of argument strength on content diagnosticity was stronger when tie strength between review provider and recipient was lower. Taylor and Ledbetter (2017) also claimed that tie strength negatively moderated the relationship between medium condition and media use violation importance. Moreover, Woisetschläger et al. (2011) proved the negative moderating effect of social ties on the link between satisfaction and loyalty intention in contractual settings such as newspaper subscriptions. Based on previous studies (Kim and Fernandez 2017; Liang and Fu 2016; Onnela et al. 2007 ; Perry-Smith 2014; Tang et al. 2016 ; Taylor and Ledbetter 2017 ; Woisetschläger et al. 2011), we propose our hypothesis. When weak ties dominate the users' social network of the SMIM service, the confirmation of values and the resulting satisfaction may be the main concerns for users. However, when a SMIM service comprises a great number of strong ties, users may tend to stay in the SMIM service to maintain desirable social relationships. In other words, strong ties weaken the effect of satisfaction on continuance intention. Hence, the present study conjectures that:

> **H5:** Tie strength negatively moderates the relationship between users' satisfaction and their continuance intention. When a SMIM service comprises a great number of strong ties, the influence of users' satisfaction on their continuance intention is weaker.

3.3 Confirmation of Social Value and Tie Strength

This study supposes that the confirmation of social value might influence tie strength between users by considering the following reasons. First, people usually use multiple information and communication technologies to connect with their friends or kinship, especially in instant messaging networks (Tseng and Hsieh 2015). When social benefits such as social support derived from maintaining connections in SMIM services are higher than expected, they are ultimately able to facilitate the formation of strong ties between users. Second, a sense of belonging benefits intimacy acceleration and relationship enhancement (Cao et al. 2013). SMIM services provide platforms for friends or peers to express their opinions, listen to the ideas of others, and resolve disagreements, all of which collectively cultivate a sentimental attachment in the groups of SMIM service users. When the perceived sense of belonging is higher than expected, tie strength between users is likely to be increased. Thus, we propose the following:

> **H6:** Tie strength is positively related to the extent user expectation on (a) maintaining interpersonal interconnectivity and (b) a sense of belonging of the SMIM service is met.

3.4 PCM in SMIM Services

PCM refers to the degree to which a user of a service believes that the people he or she communicates with also use the same service, and they tend to continually use the service in the future (Ku et al. 2013). PCM has been discussed as an important factor that influences adoption and post-adoption of interactive communication innovation (Van Slyke et al. 2007). However, researchers hold different ideas. Ku et al. (2013) explained that PCM directly affected users' continuance intention, whereas Mäntymäki and Salo (2011) argued that perceived network externalities indirectly affected continuance use intention through perceived enjoyment and usefulness. In the SMIM context, abundant SMIM services (e.g., WeChat, QQ, Line) provide many options and enable users to switch from incumbent service to another without monetary costs. The present study expects that PCM is crucial to users' use continuance. When people around users are perceived to continually use an SMIM service, the users tend to act in the same way.

> **H7:** Users' continuance intention to use an SMIM service is positively related to their PCM about the service.

4 Research Methodology

4.1 Measures

At the beginning of the questionnaire, a screening question was set up to ensure that only respondents who had previous WeChat experience participated in this survey. The screening question used in the survey was "Have you used WeChat in the last 3 months by using a mobile device such as a smartphone or a tablet (e.g., iPhone, iPad, Samsung, Windows Phone, MI, HUAWEI, OPPO, VIVO, etc.)". Afterwards, we collected and recorded their WeChat use experience. Items were adopted from existing scales, with corresponding modifications depending on the specific context. All the reworded items were measured on a seven-point Likert scale anchoring from "strongly disagree" to "strongly agree" (see Appendix 1), except for the demographic data captured using direct questioning. This study measured tie strength using items adopted from the works of Ho et al. (2003) and Mittal et al. (2008). PCM was examined using items from the study of Van Slyke et al. (2007). Satisfaction was assessed on the basis of the scales of Ho et al. (2003). Continuance intention was mainly measured using items from the works of Bhattacherjee (2001b) and Ku et al. (2013). According to Bhattacherjee (2001b), confirmation indicates the comparison between expectation and performance. Thus, we measured confirmation by asking questions in respect to whether the perceived performance of SMIM services in realizing values were better than users' expected. Items of values pertaining to maintaining interpersonal interconnectivity, entertainment value, and self-expression were adopted from the work of Dholakia et al. (2004), whereas those pertaining to purposive value and sense of belonging were adopted from the study of Cao et al. (2013).

Several methodological steps such as literature review, experts' judgment, the double translation, and the construct validity examinations were carried out to ensure the validity of the samples. In terms of content validation, the procedures include a thorough review of literature to identify the entire domain of content related to the phenomena of interest (Wynd et al. 2003), consultation with experts and members of the population, and careful specification of constructs and so on (Vogt et al. 2004). An extensive literature review was primarily conducted in our study, and we adapted all the items from previously validated sources. Moreover, experts' judgment was conducted to further guarantee the validity of the instrument. Experts should have both IS-related knowledge and WeChat use experience. A panel of 10 experts reviewed the instrument. They were asked to judge the relevance of each item in the instrument and they were also asked to provide suggestions to modify the wordings of items to fit the research context. Thereafter, a double translation of the language used for data collection was conducted to develop the measurement. As this study was conducted in Chinese, the questionnaire used was written in Chinese. Two IS doctoral students were invited to translate all the items from English to Chinese, and another two IS doctoral students were subsequently invited to translate these items from Chinese back to English. By comparing the translated English version with the original one, we could check and notice the inappropriate and unambiguous measurements. Finally, their feedback was used to correct and improve the measurements and thus ensure content validity.

4.2 Data Collection

This study conducted a web-based survey to examine the research model and hypotheses. WeChat was used because of its large user base in China, which makes it a representative SMIM service. A pretest with 20 university students in China was conducted before the main survey. The data were analyzed after the pretest, and a preliminary examination of the measurement was conducted. The results showed that the reliability and validity of the measurement were acceptable. The scale was further purified and refined on the basis of the feedback of the pretest. In the main survey, the revised questionnaires were posted online, and an invitation message with the URL leading to the questionnaires was sent to the survey participants. This process was conducted with the help of a popular online survey firm in China, and the details will be discussed subsequently. To encourage participation, we promised the anonymity of all the responses to the participants, paid for the valid responses, and used lottery as an incentive (automatically created by the online system).

Several methods were employed to ensure the quality of the sample. First, the sample from China was chosen because of the important role of tie strength in the research model. The specific Chinese context is the seedbed for breeding tie strength. Relationship, or we called *guanxi* in China, has been considered as a crucial factor and a substitute for social support (Xin and Pearce 1996). The sample chosen from China is consistent with and beneficial to the data collection. Moreover, the sample was picked from respondents with different occupations in different places to justify population generalization. We approached the sample with the help of a popular online survey firm in China, namely, Sojump (http://www.sojump.com). If a Sojump registered member responds to the email invitation and completes the online survey, Sojump charges the member roughly 6 to 100 RMB for a valid response. Due to the budget constraint and reviews from other online communication literature, we decided to collect 300 responses in this research project. Lastly, other actions were taken to solicit qualified survey responses. For instance, we targeted Chinese WeChat users as respondents, with different usage experience or different occupations in diverse areas. We also made sure that each response was from a unique IP address to avoid repetitive submissions from the same respondent.

Finally, 300 online responses were collected after two weeks. Among these responses, one was deleted because of its inconsistent answers to the different measurements of a construct and 299 usable responses were obtained. The demographic data are shown in Table 3.

5 Data Analysis

This study employed structural equation modeling (SEM) to test the research model. By comparing partial least squares SEM (PLS-SEM) and covariance-based SEM (CB-SEM), Afthanorhan (2013) revealed that PLS-SEM path modeling using SMARTPLS was appropriate to carry on the confirmatory factor analysis which was more reliable and valid. According to Hair et al. (2011), PLS-SEM does not require multivariate normality distribution for the data. An analysis of the measurement items of this study shows that some items deviate radically from normality. For example, the skewness value and kurtosis value of one item for continuance intention is -2.760 and 12.075, respectively, which indicates that the item for measuring continuance intention is not normally distributed. Therefore, PLS-SEM is suitable for this study.

5.1 Measurement Model

The measurement model was evaluated by assessing the validity and reliability of the psychometric properties. Firstly, the reliabilities of constructs were assessed using internal consistency reliability and indicator loadings (Hair et al. 2011). The scales are reliable when all the composite reliability (CR) are higher than 0.7 and the factor loadings are higher than 0.7, but the factor loadings above 0.6 are also suggested to be acceptable (Bagozzi and Yi 1988). The results indicated an acceptable reliability for this measurement model (see Table 4). The convergent validity of measurements is established when the average variance extracted (AVE) of each construct exceeds 0.50 (Fornell and Larcker 1981; Hair et al. 2011). Two items were deleted in this study because of low loadings (see Appendix 1). Table 4 shows that the convergent validity met the requirements.

Discriminant validity can be achieved when the largest correlation between constructs is less than 0.71 (Fang et al. 2014) and is lower than the square root of the AVE of each construct (Fornell and Larcker 1981). The results showed that the discriminant validity was acceptable (see Table 5). In addition, following the method of Henseler et al. (2015), we employed Heterotrait-monotrait (HTMT) ratio of correlations as an additional criterion to assess discriminant validity. It involves a comparison between the value of the HTMT and a predefined threshold. Here, the $HTMT_{.85}$ is adopted because it offers the best balance between high detection and low arbitrary violation rates (Voorhees et al. 2016). If the value of the HTMT is higher than 0.85 (i.e., the threshold of $HTMT_{.85}$), then we can conclude that there is a lack of discriminant validity. The results showed that the highest value of HTMT (i.e., the HTMT between satisfaction and perceived critical mass) was 0.76, indicating the good discriminant validity.

Common method bias (CMB) was likely suffered in this study because we used a self-reported survey. Thus, Harman's single-factor test was performed to assess the extent of CMB (Podsakoff et al. 2003). CMB exists when a single factor accounts for the majority of the covariance of the variables (Podsakoff et al. 2003 p. 889). The unrotated principal components factor analysis indicated 30.22% of the total variance, which suggested that CMB was not a threat to this study. In addition, following Liang et al. (2007) and Sun et al. (2012), we included a common method factor in the PLS model to assess the severity of CMB. The indicators of the common method factor included all indicators of the principal constructs. Then, we calculated each indicator's variances substantively explained by the principal construct and by the method. The results indicated that the average substantively explained variance of the indicators was 0.612, while the average method-based variance was 0.006 (see Appendix 2). The ratio of substantive variance to method variance was about 102:1. Moreover, most method factor loadings were not significant. Due to the small magnitude and insignificance of method variance, we concluded that CMB was not a serious concern for this study. We also tested the multicollnearity in our model, and found that the VIFs of all constructs were from 1.507 to 2.213. The result showed that multicollinearity was not a problem in our model.

Table 3 Respondent characteristics

Characteristic		Number (n = 299)	Percentage
Gender	Female	155	51.8%
	Male	144	48.2%
Age	18–24 years	40	13.4%
	25–30 years	147	49.2%
	31–38 years	92	30.8%
	> 38 years	20	6.6%
Education	High school	2	0.7%
	Junior college	27	9.0%
	Bachelor's degree	242	80.9%
	Master's degree or PhD	28	9.4%
SMIM usage experience	< 6 months	4	1.3%
	6 months–1 year	43	14.4%
	1–2 years	158	52.8%
	2–3 years	70	23.4%
	> 3 years	24	8.1%
Occupation	Student	11	3.7%
	Teacher	17	5.7%
	Office worker	113	37.8%
	Salesman	26	8.7%
	Technician	92	30.8%
	Professional	35	11.7%
	Others	5	1.6%

5.2 Structural Model

The PLS results are shown in Fig. 3. The results displayed the estimated path coefficients of the relationships hypothesized in the model, as well as the t-values and R^2 values (Chou et al. 2015). Bootstrap resampling procedure was conducted to test the significance of all paths. Most of the paths in research model were statistically significant except the path from the confirmation of sense of belonging to satisfaction.

The confirmation of values such as maintaining interconnectivity, entertainment value, purposive value, and self-expression affected satisfaction, with path coefficients of 0.154, 0.164, 0.141, 0.284, respectively. Thus, H2a, H2b, H3, and H4a were supported. These antecedents accounted for 45.8% of the variance in satisfaction. The confirmation of maintaining interconnectivity and sense of belonging significantly influenced tie strength, with path coefficients of 0.232 and 0.401, thus supporting H6a and H6b. The two constructs explained for 31.4% of the variance in tie strength. Users' continuance intention was predominantly determined by satisfaction and perceived critical mass, with path coefficients of 0.237 and 0.380. Thus, H1 and H7 were supported. Finally, tie strength was found to significantly moderate the relationship between satisfaction and continuance intention, with path coefficient of -0.150. Therefore, H5 was supported. We also examined the direct effect of tie strength on continuance intention, but the effect was insignificant (the path coefficient was 0.034 and t-value was 0.591). Overall, the antecedents of continuance intention accounted for 41.6% of the variance.

We further tested the interaction effects by performing the hierarchical test. It was used to compare the R^2 value for the interaction effect model with that for the main effects model, which excluded the interaction construct. The difference between the R^2 was used to assess the overall effect size (f^2), where 0.02, 0.15, or 0.35 had been suggested to be small, moderate, and large effects, respectively (Cohen 1988). It is important to notice that a small f^2 does not necessarily imply an unimportant effect (Chin et al. 2003). The results showed that the interaction effect had an effect size (f^2) of 0.03, which laid between the small and moderate effect size (see Table 6). The interaction effect model possessed a significantly higher explanatory power than the main effect model. Thus, tie strength had a significantly negative effect on the relationship between satisfaction and continuance intention.

6 Discussion

6.1 Discussion of Results

The current study aims to propose a theoretical model for SMIM user continuance and further explored the determinants of continuance intention in the context of SMIM services. The statistical results showed that the research model examined in

Table 4 Psychometric properties of measures.

Constructs	Item	Factor loading	Mean	S.D.
Continuance intention	CI1	0.83	6.51	0.64
(CR = 0.88; AVE = 0.65)	CI2	0.84	6.38	0.68
	CI3	0.83	6.42	0.70
	CI4	0.71	5.63	0.66
Satisfaction	SAT1	0.78	6.08	0.72
(CR = 0.85; AVE = 0.59)	SAT2	0.78	5.98	0.73
	SAT3	0.73	5.92	0.83
	SAT4	0.78	5.99	0.81
Tie strength	TS1	0.77	5.72	0.83
(CR = 0.84; AVE = 0.52)	TS2	0.77	5.59	0.89
	TS3	0.62	5.89	0.87
	TS4	0.70	5.55	0.93
	TS5	0.73	5.68	0.96
Perceived critical mass	PCM1	0.78	6.24	0.71
(CR = 0.83; AVE = 0.56)	PCM2	0.75	6.11	0.75
	PCM3	0.69	6.21	0.80
	PCM4	0.76	6.12	0.73
Purposive value	PV1	0.62	5.73	0.88
(CR = 0.88; AVE = 0.56)	PV2	0.79	5.22	1.13
	PV3	0.74	5.41	1.04
	PV4	0.75	5.47	1.15
	PV6	0.76	5.44	1.02
	PV7	0.81	5.18	1.23
Self-expression	SE1	0.80	6.03	0.86
(CR = 0.85; AVE = 0.59)	SE2	0.78	6.02	0.93
	SE3	0.77	5.74	0.99
	SE4	0.72	6.02	0.95
Entertainment value	EV1	0.82	5.90	0.86
(CR = 0.86; AVE = 0.66)	EV2	0.81	6.04	0.82
	EV3	0.81	5.84	0.89
Maintaining interpersonal interconnectivity	MII1	0.92	6.16	0.84
(CR = 0.90; AVE = 0.82)	MII2	0.89	6.07	0.81
Sense of belonging	SOB1	0.77	5.64	1.02
(CR = 0.85; AVE = 0.58)	SOB2	0.70	5.45	1.00
	SOB3	0.80	5.87	0.84
	SOB4	0.77	5.60	0.93

S.D. represents standard deviation.

this study was acceptable. This study extended expectation-confirmation model (ECM) by incorporating tie strength into the research model. Other critical drivers such as satisfaction, utilitarian value, hedonic value, social value, and perceived critical mass were also verified by the results. PLS-SEM was employed to examine the proposed model using the data collected from 299 users of SMIM services.

The analytical results in the preceding section indicated that tie strength was critical in influencing the continuance intention of SMIM users. More specifically: a) tie strength had a moderating effect on the link between satisfaction and user continuance intention; b) tie strength was influenced by the confirmation of social value; c) satisfaction was influenced by the confirmation of utilitarian value, hedonic value, and social value; d) perceived critical mass directly affected continuance intention of SMIM users. These findings offer several implications for SMIM research and practice.

As expected, tie strength exerted a negative moderating effect on satisfaction-continuance intention link. This finding implied that the effect of user satisfaction on continuance intention was weaker when social ties were strong in SMIM services. The hypothesized result is supported by a number

Table 5 Reliability, construct correlation, and the square root of AVE.

Constructs	SAT	TS	PCM	PV	SE	EV	MII	SOB
Continuance intention (CI)								
Satisfaction (SAT)	0.77							
Tie strength (TS)	0.57	0.72						
Perceived critical mass (PCM)	0.57	0.46	0.75					
Purposive value (PV)	0.44	0.45	0.24	0.75				
Self-expression (SE)	0.59	0.46	0.51	0.42	0.77			
Entertainment value (EV)	0.51	0.40	0.32	0.45	0.52	0.81		
Maintaining interpersonal Interconnectivity (MII)	0.50	0.45	0.51	0.32	0.56	0.45	0.91	
Sense of belonging (SOB)	0.52	0.52	0.41	0.46	0.58	0.51	0.53	0.76

The diagonal elements represent the square roots of the AVE.

of previous studies on exploring the moderating effect of social ties (Perry-Smith 2014; Phua et al. 2017 ; Tang et al. 2016; Taylor and Ledbetter 2017; Woisetschläger et al. 2011). For example, Woisetschläger et al. (2011) affirmed that social ties had a negative moderating impact on the satisfaction-loyalty link. The relationship between satisfaction and loyalty intention was weaker when social ties were strong versus weak. Phua et al. (2017) noted that tie strength significantly moderated the relationship between frequent use of SNSs to follow brands and brand community-related outcomes (i.e., membership intention and identification). Tang et al. (2016) found that tie strength moderated the source credibility-content diagnosticity link and the argument strength-content diagnosticity link. The content diagnosticity subsequently affected user information adoption behavior. However, the direct effect of tie strength on continuance intention was insignificant, which is similar with findings of Lee-Xian and Gilbert (2006) and Ng (2013). Lee-Xian and Gilbert (2006) posited the direct effect of tie strength (which is also called closeness in their research) on stay intention of SNS users was insignificant. Ng (2013) found that the direct effect of tie strength on purchase intention was insignificant for the East Asia group. The possible explanation is that although the building of relationships among SNS users is important, it is insufficient to retain users if there is not enough benefits (Lee-Xian and Gilbert 2006).

The results revealed that the confirmation of social value positively affected tie strength. Social value includes maintaining interpersonal interconnectivity and sense of belonging. Maintaining interpersonal interconnectivity refers to maintaining contacts with friends, keeping relationships with friends, and the resulting social benefits or social supports. In other SNS studies (Chang and Zhu 2011; Lien and Cao 2014), it is also called sociality, which is one of the chief motivations of users in using SNS (Ellison et al. 2006). Sense of belonging refers to a sense of emotional involvement with a group. For SMIM services such as WhatsApp or Facebook, they are primarily utilized to maintain relationships (Ellison et al. 2007), promote feelings of belonging (Valenzuela et al. 2009), to maintain connectivity, and for entertainment. People use these SMIM services to maintain strong ties and interact with others who typically comprise the private realm (a type of social space that characterized by relationships with known others) (Wang et al. 2016). In line with previous studies, the results of this study indicated that when social value is better realized than expected, the tie strength between SMIM users will increase.

With regards to the basic constructs of ECM, it was observed in the results that continuance intention of SMIM users was positively influenced by satisfaction, which was influenced by the confirmation of utilitarian value, hedonic value, and social value. These relationships are supported by Pereira et al. (2015) and Jin et al. (2010), who demonstrated that the disconfirmation/ confirmation of value was positively associated with user satisfaction, which affected their intention to continue online services. In the SMIM context, the confirmation of hedonic value and utilitarian value positively affected satisfaction. Moreover, the confirmation of maintaining interpersonal interconnectivity also had a positive effect on satisfaction. This is not surprising since a number of IS studies have affirmed the importance of these values in influencing satisfaction (de Oliveira and Huertas 2015; Ha and Jang 2010; Ryu et al. 2010). These findings indicated that users tend to be satisfied with an SMIM service when the service enables users to fulfill their needs of connecting with friends, gaining a sense of enjoyment, participating in activities for specific purposes, and expressing their thoughts through the service. However, the confirmation of the sense of belonging was not significantly associated with satisfaction. Potential explanations are given as follows. First, this value is adopted from studies on SNS context and is significantly associated with satisfaction in the specific SNS research context (Cao et al. 2013). Hence, sense of belonging may not be an important consideration for users in the SMIM context. Second, Herzberg (1974) addressed that hygiene factors such as interpersonal relationships did not appear to provide long-term

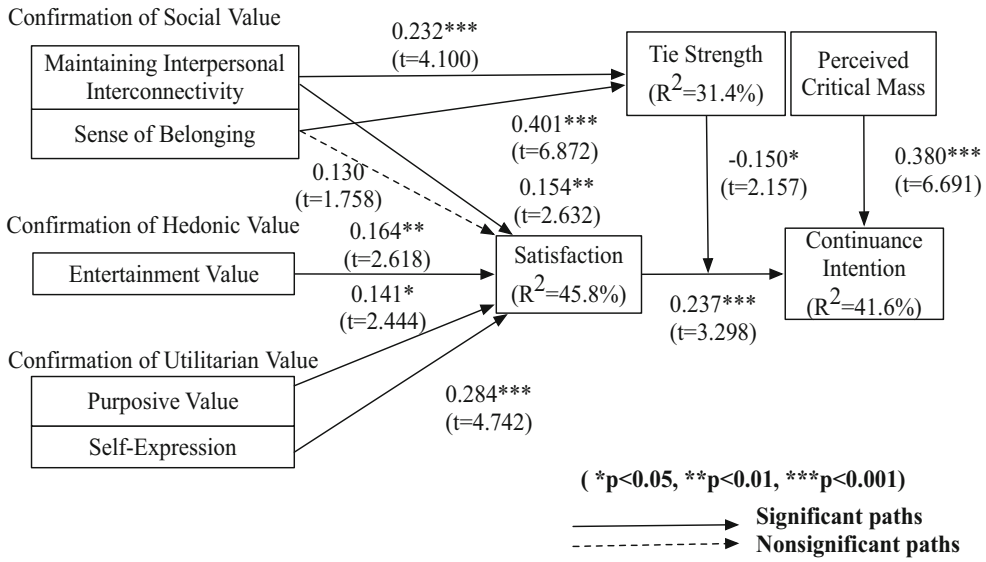

Fig. 3 Results of the research model

satisfaction, but they did prevent dissatisfaction. Consistent with this logic, sense of belonging may be a hygiene factor in the post-adoption stage of SMIM services. The confirmation of a sense of belonging does not have to positively affect satisfaction, whereas the disconfirmation of a sense of belonging leads to users' dissatisfaction.

The validated research model showed that PCM has a direct and strong effect on continuance intention of SMIM users. This is not surprising since scholars found that social influence could exert an influence on user behavior intention through attitude (Dwivedi et al. 2017; Rana et al. 2017). Moreover, the direct effect of critical mass on continuance intention has also been supported by previous studies on IS continuance (Chang et al. 2014; Ku et al. 2013).

6.2 Theoretical Implications

From the theoretical perspective, this study enhances existing knowledge in many ways. First, this study emphasizes and investigates the unexplored effect of tie strength in post-adoption research within the context of SMIM services. As Risjord (2014) claimed that human nature is a social nature. Therefore, it is important to consider social factors such as tie strength into online interpersonal communication research. From the perspective of tie strength, this study examines the way that tie strength affects continuance intention of SMIM users. The results indicated that tie strength exerted a negatively moderating effect on the link between SMIM users' satisfaction and their continuance intention. In other words, the impact of satisfaction on continuance intention may decrease when strong ties exist. For an SMIM service that has a great number of strong ties, its users may keep using the service without thinking about whether they are satisfied or not. They tend to stay in an SMIM service reluctantly even if they are not satisfied, in order to maintain strong ties in the network. This finding highlights the important role of tie strength and contributes to the post-adoption literature by enhancing our understanding towards SMIM retention from the tie strength perspective.

Second, this study has contributions to the use and development of ECM. Firstly, current studies have explored the continually use of SMIM or mobile SNS using media richness theory (Tseng et al. 2017), customer value perspective (Deng et al. 2010; Hsiao et al. 2016), Bagozzi's self-regulation framework and the uses and gratifications theory (Chaouali 2016), network externality (Zhang et al. 2017), or service quality and switching costs (Gan and Li 2015), they seldom takes ECM into consideration. This study contributes to SMIM literature by taking ECM into consideration, and specifically explores the influence of confirmation of values rather than perceived usefulness on satisfaction and tie strength, which in turn affect continuance intention of SMIM users. Secondly, the utilization of a theory in a new setting to conduct a scholarly exploration is already a way to make theoretical contribution, as suggested by Li et al. (2014). They also called for greater contextualization on IT-related research in China. The findings of this study showed that ECM was able to survive the empirical test in the SMIM context, which improved the generalization of ECM. More importantly, this study

Table 6 Hierarchical test.

	R^2
Interaction effect model	0.42
Main effect model	0.40
f^{2a}	0.03

[a] f^2 = [R^2 (interaction effect model) - R^2 (main effect model)]/(1-R^2 (interaction effect model))

integrates tie strength into ECM in the context of SMIM services, which are rarely explored (Kane et al. 2014). For many studies on mobile SNS (Deng et al. 2010 ; Gan and Li 2015), they often considered the role of switching cost on continuance intention of users. In this study, tie strength is not only the critical contextual feature but also the switching cost for retaining the SMIM users. It complements the part that ECM cannot fully explain.

Third, this study provided evidence that the confirmation of social value played an important role in enhancing tie strength in the context of SMIM service. Notably, the confirmation of sense of belonging was a stronger catalyzer for the fluctuation of tie strength compared with the confirmation of maintaining interpersonal interconnectivity. This finding may be influenced by our research background, because China is a country that emphasizes collectivism (Earley 1989). Having a sense of belonging is more important to tie strength enhancement. As the confirmation of social value is helpful in intensifying tie strength between users, further study should pay attention to users' perceived sense of belonging and maintaining interpersonal interconnectivity when studying the motivators of social capital or affective commitment.

Fourth, in addition to satisfaction, the results showed that PCM also had a direct impact on continuance intention of SMIM users. PCM was found to positively influence users' continuous use intention, which is consistent with the findings of Mäntymäki and Merikivi (2010). Moreover, the impact of PCM on continuance intention is the strongest impact. This finding showed that external social influence still had a great impact in the post-adoption stage of mobile social media. For the drivers of satisfaction, it was found that the confirmation of self-expression was the most important driver of satisfaction. This finding indicated that SMIM users had the expectations and strong desires to confirm their needs of expressing their own thoughts, ideas, things happened in daily life through SMIM service, for the purpose of indicating their competence or trustworthiness to obtain others' attractiveness. It was also found that the effect of the confirmation of sense of belonging on satisfaction was insignificant. Potential explanation is that sense of belonging plays the role of a hygiene factor, which will not lead to satisfaction when it is realized.

Finally, this study also has implications for social media research in other contexts. We highlight the role of tie strength on the sustainable usage of SMIM services. The results of this study can be utilized to explain or predict consumer behaviour in other interactive social media such as Facebook and Twitter. This argument is consistent with the finding of Gilbert (2012) that the important relational properties of social media can be generalized to different social media with homogenous features. The results also revealed that development of tie strength always involved relationship maintenance and belonging seeking. The above associations suggest that social value may be useful in explaining the continuance use of other online social media. In conclusion, this study is beneficial to explore users' post-adoption behaviour in other social media research.

6.3 Practical Implications

The results have key implications for managers. For practitioners, understanding users' continuance intention is essential for the survival and sustainability of SMIM services. In this regard, this study provides several guidelines for SMIM service providers and designers.

First, the confirmation of four values is effective in influencing satisfaction and ultimately affecting continuance intention. SMIM service providers should consistently fulfill and reinforce the social value, hedonic value, and utilitarian value offered by their services to enhance users' satisfaction. For instance, the designers of WeChat can improve the basic functions of its services by offering a wide range of channels that enable users to express their thoughts, communicate with others, conduct interesting activities, or improve social functions. Specifically, they can modify the update mechanisms in Moments of WeChat to maintain interpersonal interconnectivity. Service providers can enhance users' satisfaction and ultimately increase users' continuance intention by making efforts to increase these values.

Regarding the moderating effect of tie strength, SMIM providers need to identify the underlying mechanisms of the moderating effect of tie strength on the relationship between the satisfaction and continuance intention of SMIM users. The findings revealed that tie strength could retain dissatisfied users in an SMIM service because of the tie strength between users in the service. Therefore, tie strength is an important consideration for SMIM managers to implement and maintain their existing user base.

Meanwhile, the antecedents of tie strength are also identified. Tie strength can be intensified among SMIM users of an SMIM service when users maintain interpersonal interconnectivity or seek a sense of belonging within an SMIM service. Specifically, SMIM service providers or designers can improve existing services from the group and individual perspectives. For example, SMIM service providers can create reward mechanisms to motivate group members to help each other or implement rating mechanisms within group members. In this way, the confirmation of sense of belonging can be realized, and tie strength can be cultivated subsequently.

Finally, this study suggests that SMIM service providers should pay attention to the influence of PCM. SMIM users will continue to use a given SMIM service when they perceive that the people they communicate with use the same SMIM service and may continually use such service. Thus, SMIM service providers should encourage existing users to recommend more friends to use their SMIM services by offering privileges for newcomers or additional free services for extant users.

6.4 Limitations and Future Directions

The current study also has limitations. First, this study uses a cross-sectional design. The findings could be enhanced with a longitudinal approach. As the post-adoption behavior of SMIM users is our major concern, a longitudinal method can identify the effect of time on users' decisions to stay in an SMIM service. Besides, this study assesses the extent of CMB by performing Harman's single-factor test and the method introduced by Liang et al. (2007), and finds the minimal evidence of CMB. Further studies can take the measured latent marker variable (MLMV) approach as an additional CMB test, and it is also regarded as an effective way in assessing the extent of CMB. This study is not able to run the MLMV approach because we did not measure unrelated constructs in data collection process. Furthermore, most of the respondents have used WeChat more than one year, there may exist sampling biases and we call for further exploration. Moreover, this study emphasizes the effect of tie strength on the continuance intention of SMIM users. Future studies can develop and empirically validate the proposed model by considering other factors in a wider context. For instance, the application of SMIM services requires a mobile device and the accessibility of Internet simultaneously. If the two requirements cannot be fulfilled at the same time, SMIM services will become unavailable. Such failure and unavailability can possibly prevent users from continually using an SMIM service. However, exploring continuance intention from the tie strength perspective is worthwhile because of the possibility of acquiring different views on this issue. Additionally, this study explores continuance intention instead of actual continued use behavior and calls for the exploration of actual usage behavior in the SMIM context in the future. However, this operation is reasonable in this study because behavioral intention is a good predictor of actual behavior (Earley 1989). Finally, this study calls for further exploration of the relationship between sense of belonging and satisfaction, which may yield unexpected results. Delving into the relationship between the confirmation of sense of belonging and satisfaction and exploring the underlying mechanisms in the SMIM context will be interesting.

6.5 Conclusions

This study integrates an important but often neglected social feature (i.e., tie strength) into ECM and proposes an SMIM continuance model. Empirical testing of the proposed model showed that most of the hypotheses were supported. As a result, this study contributes to the development of a comprehensive model in understanding users' continuous use intention in the context of SMIM, by considering the potential antecedents such as tie strength, the confirmation of values, satisfaction, and perceived critical mass. In particular, the results highlighted the important role of tie strength and its key drivers. IT researchers should take careful consideration to the unique features when exploring users' post-acceptance decision process in online interactive social media. Future research on development and empirical validation of the proposed model by considering other factors in a wider context or using a longitudinal study is encouraged.

Acknowledgments This work described in this paper was supported by the National Natural Science Foundation of China (Project No. 71701195, 71472172). The authors express their thanks to the editors and the anonymous referees for their constructive suggestions.

Appendix 1

Table 7 Scale items

Please indicate your opinions about questions below (Extremely Disagree (1) / Extremely Agree (7)).

Continuance intention

CI1 I intend to continue using WeChat.

CI2 I plan to keep using WeChat.

CI3 I expect to continue using WeChat.

CI4 If I could, I would like to discontinue my use of WeChat (reverse coded).

Satisfaction

SAT1 I am satisfied with my WeChat use.

SAT2 I am pleased when I use WeChat.

SAT3 I am contented about using WeChat.

SAT4 I am absolutely delighted when using WeChat.

Tie strength

TS1 I am close to persons in WeChat.

TS2 I have strong ties with persons in WeChat.

TS3 I am familiar with persons in WeChat.

Table 7 (continued)

Please indicate your opinions about questions below (Extremely Disagree (1) / Extremely Agree (7)).
TS4 I understand the persons in WeChat well.
TS5 I have frequent contacts with persons in WeChat.
Perceived critical mass
PCM1 Many people that I communicate with use WeChat.
PCM2 The people that I communicate with will continue to use WeChat in the future.
PCM3 The people that I communicate with using WeChat will continue to use WeChat in the future.
PCM4 Of the people that I communicate with regularly, many use WeChat.
Confirmation of Values (Utilitarian Value, Hedonic Value, and Social Value):
Please indicate your perceived performance of WeChat compared with your initial expectation in realizing the following functions: ('Much lower than your expectation' (1), 'Just the same as your expectation' (4) and 'Much higher than your expectation' (7)).
Purposive value
PV1 To get information from WeChat.
PV2 To learn how to do things.
PV3 To generate ideas by using WeChat.
PV4 To negotiate or bargain.
PV5 To get someone to do something for me.*
PV6 To solve problems.
PV7 To make decisions.
Self-expression
SE1 To share my thoughts or stories to others.
SE2 To share my photos with others.
SE3 To share my knowledge with others.
SE4 To comment on others' photos, stories and so on.
Entertainment value
EV1 To be entertained.
EV2 To play.
EV3 To relax.
EV4 To pass the time away when bored.*
Maintaining interpersonal interconnectivity
MII1 To stay in touch with others.
MII2 To have something to do with others.
Sense of belonging
SOB1 To let out my emotions easily to others.
SOB2 To express my problems to others who will help.
SOB3 To talk to others when I feel lonely.
SOB4 To let others know I care about their feelings.

*Removed from the further analysis due to low loadings.

Appendix 2

Table 8 Common method bias

Construct	Indicator	Substantive factor loading (R1)	$R1^2$	Method factor loading (R2)	$R2^2$
Maintaining interpersonal interconnectivity	MII1	0.875***	0.766	-0.049	0.002
	MII2	0.940***	0.884	0.048	0.002
Sense of belonging	SOB1	0.783***	0.613	-0.013	0.000
	SOB2	0.598***	0.358	0.106	0.011
	SOB3	0.776***	0.602	0.027	0.001
	SOB4	0.870***	0.757	-0.108	0.012
Entertainment value	EV1	0.818***	0.669	0.006	0.000
	EV2	0.817***	0.667	-0.013	0.000
	EV3	0.810***	0.656	0.007	0.000
Purposive value	PV1	0.539***	0.291	0.097	0.009
	PV2	0.801***	0.642	-0.010	0.000
	PV3	0.751***	0.564	-0.015	0.000
	PV4	0.637***	0.406	0.149*	0.022
	PV6	0.799***	0.638	-0.051	0.003
	PV7	0.914***	0.835	-0.134**	0.018
Self-expression	SE1	0.807***	0.651	-0.002	0.000
	SE2	0.777***	0.604	0.009	0.000
	SE3	0.582***	0.339	0.200**	0.040
	SE4	0.914***	0.835	-0.214***	0.046
Satisfaction	SAT1	0.820***	0.672	-0.045	0.002
	SAT2	0.821***	0.674	-0.047	0.002
	SAT3	0.727***	0.529	0.007	0.000
	SAT4	0.702***	0.493	0.086	0.007
Perceived critical mass	PCM1	0.758***	0.575	0.038	0.001
	PCM2	0.744***	0.554	0.005	0.000
	PCM3	0.694***	0.482	-0.023	0.001
	PCM4	0.782***	0.612	-0.024	0.001
Continuance intention	CI1	0.786***	0.618	0.056	0.003
	CI2	0.809***	0.654	0.037	0.001
	CI3	0.832***	0.692	-0.013	0.000
	CI4	0.799***	0.638	-0.093	0.009
Average		0.777	0.612	0.001	0.006

*p < 0.05; **p < 0.01; ***p < 0.001.

References

Afthanorhan, W. (2013). A comparison of partial least square structural equation modeling (PLS-SEM) and covariance based structural equation modeling (CB-SEM) for confirmatory factor analysis. *International Journal of Engineering Science and Innovative Technology, 2*(5), 198–205.

Ang, L. (2011). Community relationship management and social media. *Journal of Database Marketing & Customer Strategy Management, 18*(1), 31–38.

Arthur, D., Sherman, C., Appel, D., & Moore, L. (2006). Why young consumers adopt interactive technologies. *Young Consumers, 7*(3), 33–38.

Babin, B. J., Darden, W. R., & Griffin, M. (1994). Work and/or fun: measuring hedonic and utilitarian shopping value. *Journal of Consumer Research, 20*(4), 644–656.

Badir, Y. F., & O'Connor, G. C. (2015). The formation of tie strength in a strategic alliance's first new product development project: the influence of project and partners' characteristics. *Journal of Product Innovation Management, 32*(1), 154–169.

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science, 16*(1), 74–94.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*(3), 497–529.

Bhattacherjee, A. (2001a). An empirical analysis of the antecedents of electronic commerce service continuance. *Decision Support Systems, 32*(2), 201–214.

Bhattacherjee, A. (2001b). Understanding information systems continuance: an expectation-confirmation model. *MIS Quarterly, 25*(3), 351–370.

Bhattacherjee, A., & Premkumar, G. (2004). Understanding changes in belief and attitude toward information technology usage: a theoretical model and longitudinal test. *MIS Quarterly, 28*(2), 229–254.

Bhattacherjee, A., Perols, J., & Sanford, C. (2008). Information technology continuance: a theoretic extension and empirical test. *The Journal of Computer Information Systems, 49*(1), 17–26.

Brown, J., Broderick, A. J., & Lee, N. (2007). Word of mouth communication within online communities: conceptualizing the online social network. *Journal of Interactive Marketing, 21*(3), 2–20.

Brown, S. A., Venkatesh, V., & Goyal, S. (2012). Expectation confirmation in technology use. *Information Systems Research, 23*(2), 474–487.

Brown, S. A., Venkatesh, V., & Goyal, S. (2014). Expectation confirmation in information systems research: a test of six competing models. *MIS Quarterly, 38*(3), 729–756.

Cao, H., Jiang, J., Oh, L.-B., Li, H., Liao, X., & Chen, Z. (2013). A Maslow's hierarchy of needs analysis of social networking services continuance. *Journal of Service Management, 24*(2), 170–190.

Chang, Y. P., & Zhu, D. H. (2011). Understanding social networking sites adoption in China: a comparison of pre-adoption and post-adoption. *Computers in Human Behavior, 27*(5), 1840–1848.

Chang, I.-C., Liu, C.-C., & Chen, K. (2014). The effects of hedonic/utilitarian expectations and social influence on continuance intention to play online games. *Internet Research, 24*(1), 21–45.

Chaouali, W. (2016). Once a user, always a user: enablers and inhibitors of continuance intention of mobile social networking sites. *Telematics and Informatics, 33*(4), 1022–1033.

Chen, A., Lu, Y., Wang, B., Zhao, L., & Li, M. (2013). What drives content creation behavior on SNSs? a commitment perspective. *Journal of Business Research, 66*(12), 2529–2535.

Cheung, C. M., & Lee, M. K. (2009). Understanding the sustainability of a virtual community: model development and empirical test. *Journal of Information Science, 35*(3), 279–298.

Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: results from a monte carlo simulation study and an electronic-mail emotion/adoption atudy. *Information Systems Research, 14*(2), 189–217.

Chou, C.-H., Wang, Y.-S., & Tang, T.-I. (2015). Exploring the determinants of knowledge adoption in virtual communities: a social influence perspective. *International Journal of Information Management, 35*(3), 364–376.

Church, K., & de Oliveira, R. (2013). *What's up with whatsapp? comparing mobile instant messaging behaviors with traditional SMS*. In *Paper presented at the Proceedings of the 15th international conference on Human-computer interaction with mobile devices and services*. Munich: GERMANY.

CNNIC. (2016). *2015 Research report on users behavior of social apps in China*. Retrieved from http://www.cnnic.net.cn/hlwfzyj/hlwxzbg/

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

ComScore. (2015). *2015 U.S. digital future in focus*. Retrieved from http://www.comscore.com/Insights/Presentations-and-Whitepapers/2015/2015-US-Digital-Future-in-Focus.

de Oliveira, M. J., & Huertas, M. K. Z. (2015). Does life satisfaction influence the intention (We-Intention) to use Facebook? *Computers in Human Behavior, 50*, 205–210.

Deloitte. (2014). *Short messaging services versus instant messaging: value versus volume*. In *Retrieved from* http://www2.deloitte.com/content/dam/Deloitte/au/Documents/technology-media-telecommunications/deloitte-au-tmt-short-messaging-services-versus-instant-messaging-011014.pdf.

Deng, Z., Lu, Y., Wei, K. K., & Zhang, J. (2010). Understanding customer satisfaction and loyalty: an empirical study of mobile instant messages in China. *International Journal of Information Management, 30*(4), 289–300.

Dholakia, U. M., Bagozzi, R. P., & Pearo, L. K. (2004). A social influence model of consumer participation in network-and small-group-based virtual communities. *International Journal of Research in Marketing, 21*(3), 241–263.

Dwivedi, Y. K., Wastell, D., Laumer, S., Henriksen, H. Z., Myers, M. D., Bunker, D.,. .. Srivastava, S. C. (2015). Research on information systems failures and successes: status update and future directions. *Information Systems Frontiers, 17*(1), 143-157.

Dwivedi, Y. K., Rana, N. P., Jeyaraj, A., Clement, M., & Williams, M. D. (2017). Re-examining the unified theory of acceptance and use of technology (UTAUT): towards a revised theoretical model. *Information Systems Frontiers*, 1–16.

Earley, P. C. (1989). Social loafing and collectivism: a comparison of the United States and the People's Republic of China. *Administrative Science Quarterly, 34*(4), 565–581.

Ellison, N. B., Steinfield, C., & Lampe, C. (2006). *Spatially bounded online social networks and social capital: the role of Facebook Paper presented at the The annual conference of the international communication association (ICA)*. Germany: Dresden.

Ellison, N. B., Steinfield, C., & Lampe, C. (2007). The benefits of Facebook "friends": social capital and college students' use of online social network sites. *Journal of Computer-Mediated Communication, 12*(4), 1143–1168.

Fang, Y., Qureshi, I., Sun, H., McCole, P., Ramsey, E., & Lim, K. H. (2014). Trust, satisfaction, and online repurchase intention: the moderating role of perceived effectiveness of e-commerce institutional mechanisms. *MIS Quarterly, 38*(2), 407–427.

Festinger, L. (1957). *A theory of cognitive dissonance* (Vol. 2): Stanford university press.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50.

Gan, C., & Li, H. (2015). Understanding continuance intention of mobile instant messaging. *Industrial Management & Data Systems, 115*(4), 646–660.

Gao, L., & Waechter, K. A. (2017). Examining the role of initial trust in user adoption of mobile payment services: an empirical investigation. *Information Systems Frontiers, 19*(3), 525–548.

Gilbert, E. (2012). *Predicting tie strength in a new medium*. In *Paper presented at the Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work*. Seattle, Washington: USA.

Gilbert, E., & Karahalios, K. (2009). *Predicting tie strength with social media.* Paper presented at the Proceedings of the SIGCHI conference on human factors in computing systems.

Gong, X., Lee, M. K., & Liu, Z. (2015). *Understanding the effect of tie strength on continuance intention of second-generation mobile instant messaging services.* Paper presented at the the 19th Pacific Asia Conference on Information Systems, Singapore.

Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology, 78*(6), 1360–1380.

Granovetter, M. (1983). The strength of weak ties: a network theory revisited. *Sociological Theory, 1*(1), 201–233.

Ha, J., & Jang, S. S. (2010). Perceived values, satisfaction, and behavioral intentions: the role of familiarity in Korean restaurants. *International Journal of Hospitality Management, 29*(1), 2–13.

Hagerty, B. M., Lynch-Sauer, J., Patusky, K. L., Bouwsema, M., & Collier, P. (1992). Sense of belonging: a vital mental health concept. *Archives of Psychiatric Nursing, 6*(3), 172–177.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: indeed a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139–152.

Hanna, R., Rohm, A., & Crittenden, V. L. (2011). We're all connected: the power of the social media ecosystem. *Business Horizons, 54*(3), 265–273.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115–135.

Herzberg, F. (1974). Motivation-hygiene profiles: pinpointing what ails the organization. *Organizational Dynamics, 3*(2), 18–29.

Ho, V. T., Ang, S., & Straub, D. (2003). When subordinates become IT contractors: persistent managerial expectations in IT outsourcing. *Information Systems Research, 14*(1), 66–86.

Hoffman, M., Richmond, J., Morrow, J., & Salomone, K. (2002). Investigating "sense of belonging" in first-year college students. *Journal of College Student Retention: Research, Theory & Practice, 4*(3), 227–256.

Hong, S., Thong, J. Y., & Tam, K. Y. (2006). Understanding continued information technology usage behavior: a comparison of three models in the context of mobile internet. *Decision Support Systems, 42*(3), 1819–1834.

Hong, S.-J., Thong, J. Y., Moon, J.-Y., & Tam, K.-Y. (2008). Understanding the behavior of mobile data services consumers. *Information Systems Frontiers, 10*(4), 431.

Hossain, M. A., & Quaddus, M. (2012). Expectation–confirmation theory in information system research: A review and analysis. *Information systems theory* (pp. 441-469): Springer.

Hsiao, C.-C., & Chiou, J.-S. (2012). The effect of social capital on community loyalty in a virtual community: test of a tripartite-process model. *Decision Support Systems, 54*(1), 750–757.

Hsiao, C.-H., Chang, J.-J., & Tang, K.-Y. (2016). Exploring the influential factors in continuance usage of mobile social Apps: satisfaction, habit, and customer value perspectives. *Telematics and Informatics, 33*(2), 342–355.

Hsu, C.-L., & Lu, H.-P. (2004). Why do people play on-line games? an extended TAM with social influences and flow experience. *Information Management, 41*(7), 853–868.

Hsu, M. H., Chiu, C. M., & Ju, T. L. (2004). Determinants of continued use of the WWW: an integration of two theoretical models. *Industrial Management & Data Systems, 104*(9), 766–775.

Huffaker, D. (February 2006). *Teen blogs exposed: the private lives of teens made public.* Paper presented at the Proceedings of American Association for the Advancement of Science (AAS), St. Louis, MO.

Jin, X.-L., Lee, M. K. O., & Cheung, C. M. K. (2010). Predicting continuance in online communities: model development and empirical test. *Behaviour & Information Technology, 29*(4), 383–394.

Jones, T. O. (1996). Why satisfied customers defect. *Journal of Management in Engineering, 12*(6), 11–11.

Kane, G. C., Alavi, M., Labianca, G. J., & Borgatti, S. P. (2014). What's different about social media networks? a framework and research agenda. *MIS Quarterly, 38*(1), 275–304.

Kapoor, K. K., Dwivedi, Y. K., & Williams, M. D. (2015). Examining the role of three sets of innovation attributes for determining adoption of the interbank mobile payment service. *Information Systems Frontiers, 17*(5), 1039–1056.

Khatibi, A. A., Ismail, H., & Thyagarajan, V. (2002). What drives customer loyalty: an analysis from the telecommunications industry. *Journal of Targeting, Measurement and Analysis for Marketing, 11*(1), 34–44.

Kietzmann, J. H., Hermkens, K., McCarthy, I. P., & Silvestre, B. S. (2011). Social media? get serious! understanding the functional building blocks of social media. *Business Horizons, 54*(3), 241–251.

Kim, B. (2010). An empirical investigation of mobile data service continuance: incorporating the theory of planned behavior into the expectation–confirmation model. *Expert Systems with Applications, 37*(10), 7033–7039.

Kim, M., & Fernandez, R. M. (2017). Strength matters: tie strength as a causal driver of networks' information benefits. *Social Science Research, 65*, 268–281.

Kim, D. J., & Hwang, Y. (2012). A study of mobile internet user's service quality perceptions from a user's utilitarian and hedonic value tendency perspectives. *Information Systems Frontiers, 14*(2), 409–421.

Ku, Y.-C., Chen, R., & Zhang, H. (2013). Why do users continue using social networking sites? an exploratory study of members in the United States and Taiwan. *Information Management, 50*(7), 571–581.

Lai, T. L. (2004). Service quality and perceived value's impact on satisfaction, intention and usage of short message service (SMS). *Information Systems Frontiers, 6*(4), 353–368.

Lee, M.-C. (2010). Explaining and predicting users' continuance intention toward e-learning: an extension of the expectation–confirmation model. *Computers & Education, 54*(2), 506–516.

Lee, J., & Kim, S. (2011). Exploring the role of social networks in affective organizational commitment: network centrality, strength of ties, and structural holes. *The American Review of Public Administration, 41*(2), 205–223.

Lee-Xian, Y., & Gilbert, B. (2006). *Investigation of the effects of members' closeness size and IT in virtual communities: the social network perspective*. In *Paper presented at the the Proceedings of the Twelfth Americas Conference on Information Systems (AMCIS)*. Acapulco: Mexico.

Levin, D. Z., & Cross, R. (2004). The strength of weak ties you can trust: the mediating role of trust in effective knowledge transfer. *Management Science, 50*(11), 1477–1490.

Li, L., Gao, P., & Mao, J.-Y. (2014). Research on IT in China: a call for greater contextualization. *Journal of Information Technology, 29*(3), 208–222.

Liang, H., & Fu, K.-w. (2016). Network redundancy and information diffusion: the impacts of information redundancy, similarity, and tie strength. *Communication Research*, 1–23.

Liang, H., Saraf, N., Hu, Q., & Xue, Y. (2007). Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management. *MIS Quarterly, 31*(1), 59–87.

Liang, T.-P., Ho, Y.-T., Li, Y.-W., & Turban, E. (2011). What drives social commerce: the role of social support and relationship quality. *International Journal of Electronic Commerce, 16*(2), 69–90.

Lien, C. H., & Cao, Y. (2014). Examining WeChat users' motivations, trust, attitudes, and positive word-of-mouth: evidence from China. *Computers in Human Behavior, 41*, 104–111.

Lou, H., Luo, W., & Strong, D. (2000). Perceived critical mass effect on groupware acceptance. *European Journal of Information Systems, 9*(2), 91–103.

Lowry, P. B., Gaskin, J., & Moody, G. D. (2015). Proposing the multimotive information systems continuance model (MISC) to better explain end-user system evaluations and continuance intentions. *Journal of the Association for Information Systems, 16*(7), 515–579.

Mäntymäki, M., & Merikivi, J. (2010). *Investigating the drivers of the continuous use of social virtual worlds*. In *Paper presented at the 43rd Hawaii International Conference on System Sciences*. Hawaii: USA.

Mäntymäki, M., & Salo, J. (2011). Teenagers in social virtual worlds: continuous use and purchasing behavior in Habbo hotel. *Computers in Human Behavior, 27*(6), 2088–2097.

Marsden, P. V., & Campbell, K. E. (1984). Measuring tie strength. *Social Forces, 63*(2), 482–501.

Meng, L.-S., Shiu, D.-s., Yeh, P.-C., Chen, K.-C., & Lo, H.-Y. (2012). Low power consumption solutions for mobile instant messaging. *IEEE Transactions on Mobile Computing, 11*(6), 896–904.

Merton, R. K. (1936). The unanticipated consequences of purposive social action. *American Sociological Review, 1*(6), 894–904.

Mittal, B., & Lassar, W. M. (1998). Why do customers switch? the dynamics of satisfaction versus loyalty. *Journal of Services Marketing, 12*(3), 177–194.

Mittal, V., Huppertz, J. W., & Khare, A. (2008). Customer complaining: the role of tie strength and information control. *Journal of Retailing, 84*(2), 195–204.

Ng, C. S.-P. (2013). Intention to purchase on social commerce websites across cultures: a cross-regional study. *Information Management, 50*(8), 609–620.

Nguyen, T. T., Harper, F. M., Terveen, L., & Konstan, J. A. (2017). User personality and user satisfaction with recommender systems. *Information Systems Frontiers*, 1–17.

Oliver, R. L. (1980). A cognitive model of the antecedents and consequences of satisfaction decisions. *Journal of Marketing Research, 17*(4), 460–469.

Onnela, J.-P., Saramäki, J., Hyvönen, J., Szabó, G., Lazer, D., Kaski, K., et al. (2007). Structure and tie strengths in mobile communication networks. *Proceedings of the National Academy of Sciences, 104*(18), 7332–7336.

Pereira, F. A. d. M., Ramos, A. S. M., Andrade, A. P. V. d., & Oliveira, B. M. K. d. (2015). Use of virtual learning environments: a theoretical model using decomposed expectancy disconfirmation theory. *Journal of Information Systems and Technology Management, 12*(2), 333–350.

Perry-Smith, J. E. (2014). Social network ties beyond nonredundancy: an experimental investigation of the effect of knowledge content and tie strength on creativity. *Journal of Applied Psychology, 99*(5), 831–846.

Phua, J., Jin, S. V., & Kim, J. J. (2017). Gratifications of using Facebook, Twitter, Instagram, or Snapchat to follow brands: The moderating effect of social comparison, trust, tie strength, and network homophily on brand identification, brand engagement, brand commitment, and membership intention. *Telematics and Informatics, 34*(1), 412–424.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879–902.

Quan-Haase, A., & Young, A. L. (2010). Uses and gratifications of social media: a comparison of Facebook and instant messaging. *Bulletin of Science, Technology & Society, 30*(5), 350–361.

Rana, N. P., Dwivedi, Y. K., & Williams, M. D. (2015a). A meta-analysis of existing research on citizen adoption of e-government. *Information Systems Frontiers, 17*(3), 547–563.

Rana, N. P., Dwivedi, Y. K., Williams, M. D., & Weerakkody, V. (2015b). Investigating success of an e-government initiative: validation of an integrated IS success model. *Information Systems Frontiers, 17*(1), 127–142.

Rana, N. P., Dwivedi, Y. K., Lal, B., Williams, M. D., & Clement, M. (2017). Citizens' adoption of an electronic government system: towards a unified view. *Information Systems Frontiers, 19*(3), 549–568.

Rau, P.-L. P., Gao, Q., & Ding, Y. (2008). Relationship between the level of intimacy and lurking in online social network services. *Computers in Human Behavior, 24*(6), 2757–2770.

Risjord, M. (2014). *Philosophy of social science: a contemporary introduction*. Routledge.

Ryu, K., Han, H., & Jang, S. (2010). Relationships among hedonic and utilitarian values, satisfaction and behavioral intentions in the fast-casual restaurant industry. *International Journal of Contemporary Hospitality Management, 22*(3), 416–432.

Seibert, S. E., Kraimer, M. L., & Liden, R. C. (2001). A social capital theory of career success. *Academy of Management Journal, 44*(2), 219–237.

Shareef, M. A., Kumar, V., Dwivedi, Y. K., & Kumar, U. (2016). Service delivery through mobile-government (mGov): driving factors and cultural impacts. *Information Systems Frontiers, 18*(2), 315–332.

Sharma, S. K. (2017). Integrating cognitive antecedents into TAM to explain mobile banking behavioral intention: a SEM-neural network modeling. *Information Systems Frontiers*, 1–13.

Skogland, I., & Siguaw, J. A. (2004). Are your satisfied customers loyal? *Cornell Hotel and Restaurant Administration Quarterly, 45*(3), 221–234.

Sohrabi, M. K., & Akbari, S. (2016). A comprehensive study on the effects of using data mining techniques to predict tie strength. *Computers in Human Behavior, 60*, 534–541.

Steffes, E. M., & Burgee, L. E. (2009). Social ties and online word of mouth. *Internet Research, 19*(1), 42–59.

Sun, Y., Fang, Y., Lim, K. H., & Straub, D. (2012). User satisfaction with information technology service delivery: a social capital perspective. *Information Systems Research, 23*(4), 1195–1211.

Tang, J., Sun, Y., Yang, S., & Sun, Y. (2016). *Revisit the information adoption model by exploring the moderating role of tie strength: a perspective from construal level theory*. In *Paper presented at the the 20th Pacific Asia Conference on Information Systems*. Chiayi: Taiwan.

Taylor, S. H., & Ledbetter, A. M. (2017). Extending media multiplexity theory to the extended family: communication satisfaction and tie strength as moderators of violations of media use expectations. *New Media & Society, 19*(9), 1369–1387.

Thong, J. Y., Hong, S.-J., & Tam, K. Y. (2006). The effects of post-adoption beliefs on the expectation-confirmation model for information technology continuance. *International Journal of Human-Computer Studies, 64*(9), 799–810.

Tidwell, L. C., & Walther, J. B. (2002). Computer-mediated communication effects on disclosure, impressions, and interpersonal evaluations: getting to know one another a bit at a time. *Human Communication Research, 28*(3), 317–348.

Tseng, S.-F., & Hsieh, Y. P. (2015). The implications of networked individualism for social participation: how mobile phone, e-mail, and IM networks afford social participation for rural residents in Taiwan. *American Behavioral Scientist, 59*(9), 1157–1172.

Tseng, F.-C., Cheng, T., Li, K., & Teng, C.-I. (2017). How does media richness contribute to customer loyalty to mobile instant messaging? *Internet Research, 27*(3), 520–537.

Valenzuela, S., Park, N., & Kee, K. F. (2009). Is there social capital in a social network site?: Facebook use and college students' life satisfaction, trust, and participation. *Journal of Computer-Mediated Communication, 14*(4), 875–901.

Van Dijck, J. (2013). *The culture of connectivity: a critical history of social media*. UK: Oxford University Press.

Van Slyke, C., Ilie, V., Lou, H., & Stafford, T. (2007). Perceived critical mass and the adoption of a communication technology. *European Journal of Information Systems, 16*(3), 270–283.

Vatanasombut, B., Igbaria, M., Stylianou, A. C., & Rodgers, W. (2008). Information systems continuance intention of web-based applications customers: the case of online banking. *Information Management, 45*(7), 419–428.

Venkatesh, V., & Goyal, S. (2010). Expectation disconfirmation and technology adoption: polynomial modeling and response surface analysis. *MIS Quarterly, 34*(2), 281–303.

Vogt, D. S., King, D. W., & King, L. A. (2004). Focus groups in psychological assessment: enhancing content validity by consulting members of the target population. *Psychological Assessment, 16*(3), 231–243.

Voorhees, C. M., Brady, M. K., Calantone, R., & Ramirez, E. (2016). Discriminant validity testing in marketing: an analysis, causes for concern, and proposed remedies. *Journal of the Academy of Marketing Science, 44*(1), 119–134.

Wang, Y., Li, Y., Semaan, B., & Tang, J. (2016). *Space collapse: reinforcing, reconfiguring and enhancing Chinese social practices through WeChat. Paper presented at the the Proceedings of the Tenth International AAAI Conference on Web and Social Media*. Germany: Cologne.

WeAreSocial. (2015). *Digital, social & mobile in 2015*. Retrieved from http://www.199it.com/archives/326417.html

Williams, A. L., & Merten, M. J. (2011). iFamily: internet and social media technology in the family context. *Family and Consumer Sciences Research Journal, 40*(2), 150–170.

Woisetschläger, D. M., Lentz, P., & Evanschitzky, H. (2011). How habits, social ties, and economic switching barriers affect customer loyalty in contractual service settings. *Journal of Business Research, 64*(8), 800–808.

Wu, T., Lu, Y., Gong, X., & Gupta, S. (2017). A study of active usage of mobile instant messaging application: an attachment theory perspective. *Information Development, 33*(2), 153–168.

Wynd, C. A., Schmidt, B., & Schaefer, M. A. (2003). Two quantitative approaches for estimating content validity. *Western Journal of Nursing Research, 25*(5), 508–518.

Xin, K. K., & Pearce, J. L. (1996). Guanxi: connections as substitutes for formal institutional support. *Academy of Management Journal, 39*(6), 1641–1658.

Xu, X., Ma, W. W. K., & See-Too, E. W. K. (2010). Will mobile video become the killer application for 3G mobile Internet? a model of media convergence acceptance. *Information Systems Frontiers, 12*(3), 311–322.

Xu, X., Thong, J. Y., & Tam, K. Y. (2017). Winning back technology disadopters: testing a technology readoption model in the context of mobile internet services. *Journal of Management Information Systems, 34*(1), 102–140.

Yi, Y. (1990). A critical review of consumer satisfaction. *Review of. Marketing, 4*(1), 68–123.

Yoon, S., & Suh, H. (2004). Ensuring IT consulting SERVQUAL and user satisfaction: a modified measurement tool. *Information Systems Frontiers, 6*(4), 341–351.

Zhang, C.-B., Li, Y.-N., Wu, B., & Li, D.-J. (2017). How WeChat can retain users: roles of network externalities, social interaction ties, and perceived values in building continuance intention. *Computers in Human Behavior, 69*, 284–293.

Zhao, L., & Lu, Y. (2012). Enhancing perceived interactivity through network externalities: an empirical study on micro-blogging service satisfaction and continuance intention. *Decision Support Systems, 53*(4), 825–834.

Zheng, C., Yu, X., & Jin, Q. (2017). How user relationships affect user perceived value propositions of enterprises on social commerce platforms. *Information Systems Frontiers, 19*(6), 1261–1271.

Zhou, T., & Lu, Y. (2011). Examining mobile instant messaging user loyalty from the perspectives of network externalities and flow experience. *Computers in Human Behavior, 27*(2), 883–889.

Xiuyuan Gong is currently a Research Assistant in School of Management, University of Science and Technology of China. Her current research interests include IT post-adoption and user behavior, social media analysis, innovation management, and case study methods research. Her research articles have been published in Asia Pacific Journal of Marketing and Logistics and many preeminent IS conference proceedings including International Conference on Information Systems (ICIS) and Pacific Asia Conference on Information Systems (PACIS).

Matthew K. O. Lee is a Chair Professor of Information Systems & E-Commerce at the College of Business, City University of Hong Kong. He holds a Ph.D. degree from the University of Manchester (UK). He has a research and professional interest in IT based innovation adoption and diffusion, knowledge management, social computing, electronic commerce, and legal informatics. His publications in the information systems and electronic commerce areas include a book as well as over one hundred referred articles in international journals, conference proceedings, and research textbooks. He has published in top journals in his field and his work has received numerous citations.

Zhiying Liu is a Professor in School of Management, Uiversity of Science and Technology of China. His research interests mainly focus on innovationn management, industrial economics, innovation and internet finance. His research articles have been published in several journals such as Technology Analysis & Strategic Management, Internet Research, and Journal of Business Research.

Xiabing Zheng is an Associate Professor in School of Management, University of Science and Technology of China. She received her PhD from the joint program between City University of Hong Kong and University of Science and Technology of China. Her research interests include e-commerce, social media, IT adoption and post-adoption. Her research articles have been published in Journal of the Operational Research Society, Computers in Human Behavior, Information Technology and People, International Journal of Information Management and Internet Research.