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Perceived critical mass and collective intention in social media-supported small group communication

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ABSTRACT

The increasing popularity of Web 2.0 has dramatically changed the way in which people communicate with others in their daily life or work. However, the use of social media is fundamentally different from that of traditional information technologies. Specifically, it requires collective efforts and interdependence between two or more people, and thus the usage behavior is no longer an individual's own decision or plan. Built on critical mass theory and social influence processes, this study tries to make an attempt to understand the determinants of collective intention (we-intention), which represents one's perception of a group of people acting as a unit. Instant messaging, one of the most popular social media platforms, has been chosen for investigation, and findings from a survey showed that perceived critical mass influenced we-intention both directly and indirectly through group norm and social identity. Recognizing the importance and relevance of collective intention will advance current understanding beyond individual intention-based models which are widely adopted in prior IS research. This study may be limited by having not included other alternative social technologies, but we leave this work for future research.

1. Introduction

Today, more than a billion individuals around the world are connected online with social technologies such as wikis, podcasts, weblogs, twitter, social networking services and instant messaging. Among all the social technologies, instant messaging is particularly popular and heavily used by Internet users for both social communication and business collaboration purpose. With the huge user base and great business potentials, instant messaging has become an increasingly important medium of communications in the workplace. It was reported that 27% of the survey respondents sent instant messaging with their co-workers to improve productivity and mange working relationships (Li, Chau, & Slyke, 2010). Instant messaging, in fact, possesses many unique features which make it possible for supporting distributed team collaboration. For example, instant messaging provides real-time communication and presence management, which enable its users to determine if the communication partners are online and available to chat. More important, instant messaging also supports the building and sustaining of user-driven communities. Some embedded features such as IM Group or group discussion room allow its users to create a permanent or temporary group structure, add their colleagues to the respective groups, engage in regular in-group discussions, accomplish a common task or goal together with other members, and simultaneously manage multiple working groups. With the help of these features, instant messaging-enabled groups or communities are established and small group-based communication is facilitated. Instant messaging thus help to create a highly interactive online shared space through which group members can create, share, exchange or discuss users-generated content or work-related issues. The business use of instant messaging is also expected to continue growing in response to the increase in both team collaboration and real-time dynamics already taking place within the current business environment (Li et al., 2010).

Over the past two decades, a large amount of studies in IS adoption and diffusion have adopted the Theory of Reasoned Action and its variants, such as Technology Acceptance Model (Davis, 1989) and Unified Theory of Acceptance and Use of Technology (Venkatesh, Morris, Davis, & Davis, 2003) to explain information technology usage behavior across a broad range of technologies and user populations. Some studies also have been devoted to the understanding of instant messaging acceptance (e.g., Lou, Luo, & Strong, 2000; Hsu & Lu, 2004; Koo, Wati, & Jung, 2011; Li et al., 2010; Slyke, Ilie, Lou, & Stafford, 2007; Strader, Ramaswami, & Houle,

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2007). However, these studies primarily adopted the individual intention-based models with a specific focus on the cognitive, emotional or social aspects of technology adoption. The conceptualization of decision making for social technologies, such as instant messaging, is fundamentally different from what we previously conducted. This is because decision making with the use of social media often involves two or more people, and thus mutually coordinated and interdependent effort exists. The perception about other partners' simultaneous usage behavior is believed as an important reason for people to adopt or not a social technology. In this sense, social media acceptance greatly depends on one's perception of the group's (or social category with which people will use such technologies together) collective activities. The classic individual intention-based models, such as TRA, TAM, UTAUT and the like, which theorize human behavioral intention as a person's individual decision or plan to perform an action by him/herself alone thus may not provide enough insights to explain the dynamic phenomenon involved in interactive communication technologies that "*require multiple users and cannot be used successfully by one person acting alone*" (Soe & Markus, 1993, p. 213).

To address this concern, a growing number of philosophers started to explore the issue of collective intention from the conceptual and logical aspects (e.g., Gilbert, 1989; Bratman, 1997; Tuomela, 2008). They have argued that individual intention alone cannot explain collective action where common interests, goals or values are involved. Instead, joint action should be investigated through joint (also called shared or collective) intention. Tuomela (2008) further contended that "*collective intentionality in its central sense is based on 'we-thinking', thinking in terms of a 'we-perspective'*" (p. 3). In this study, the concept of we-intention, which refers to an individual's subjective perception of the extent to which a particular group or social category will engage in a target collective behavior, is used as a new basis to explore the adoption and use of social technologies, and instant messaging in particular. Perceived critical mass, which represents "*the degree to which a person believes that most of his or her peers are using the system*" (Lou et al., 2000, p. 95) is believed to be the prerequisite of we-intention in this study. Building on critical mass theory and social influence processes, this study develops and empirically examines a theoretical model to explain intentional social action in instant messaging.

In the next section, the theoretical background and research hypotheses are addressed. The third section describes a survey study of instant messaging users to empirically test the research model. The fourth section discusses the findings of this study. This paper is concluded by describing the implications for both research and practice, as well as the limitations of the study and future research directions.

2. Theoretical background and hypotheses

Web 2.0 opens up a new world for communication and interaction. With the use of social technologies, collective activities can be easily coordinated and facilitated. For example, we can collaborate and work on multiple projects with instant messenger. We also can jointly create and write blogs for information sharing, or we use social networking sites, such as Facebook, to share our personal stories, pictures, and videos with our friends. It is noticeable that people often use collective notions of intention ("we intend to do") when talking about social technologies. In this section, the concept of we-intention thus will be first introduced.

In this study, social influence processes and critical mass theory are used to develop a model for examining we-intention formation. In particular, social influence processes have been widely used to explain group and social behavior (Bagozzi & Lee, 2002; Dholakia, Bagozzi, & Pearo, 2004; Shen, Lee, Cheung, & Chen, 2010), and a critical mass of active users may provide the necessary conditions for cooperative and coordinated behavior to occur (Markus, 1987). Therefore, the research model explores the effects of social influence factors and perceived critical mass on we-intention, with a special focus on the direct and indirect effects of perceived critical mass. A description of the research model and justifications for the hypotheses will be addressed in the following sections. The research model is developed as depicted in Fig. 1.

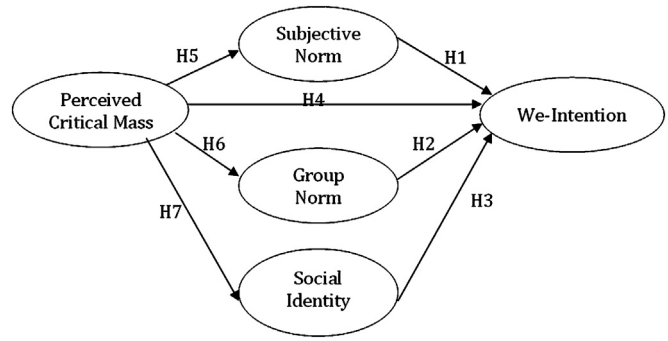


Fig. 1. Research model.

2.1. We-intention

We-intention is often regarded as an individual's intention to perform a collective action with a group of people who are jointly committed to doing something as a body (Bagozzi & Lee, 2002). It is worth noting that the "*intentional subject of a we-intention is 'we' while the ontological subject of a we-intention is a single agent*" (Tuomela, 2008, p. 9). Different from the traditional individual intention, the concept of we-intention relies more on one's perception as a group member or an agent of a group, and taking the group as the target for intention formation (Bagozzi, 2007). The concept of "we-intention" was initially explored by philosophic scholars who primarily focused on the conceptual and logical aspects (Bratman, 1997; Gilbert, 1989; Tuomela, 2000, 2005). Not until recently, some studies in social psychology and marketing started to concentrate on measurement and hypothesis testing, and adopted this concept to explain online social behaviors (Bagozzi & Dholakia, 2006; Dholakia et al., 2004). Prior empirical studies on we-intention also have found that social influence factors, such as group norm and social identity, exerted significant effect on participation we-intention in virtual communities (Bagozzi & Dholakia, 2006; Dholakia et al., 2004; Shen et al., 2010).

There are several features that distinguish we-intention from the traditional individual intention (Tuomela, 2000, 2005). First of all, the target is a singular subject in individual intention, whereas plural in we-intention. It is a group of people instead of an individual that acts or experiences an event. Intention thus is developed in relation to the group of people and the behavior is perceived as a group-referent intentional social action. Second, there is a difference in the goal achievement process. As to we-intention, the intention content is collectively accepted by each participant who functions as a member of the group, and participants have a collective commitment toward and shared authority over the joint action. However, for individual intention, a given behavior is solely accepted and controlled by an individual him/herself. Third, the satisfaction conditions are also different for the two intentions. The satisfaction condition of we-intention assumes that if the intention content is satisfying to one member, it is satisfying to all group members. This is because all participants with we-intentions have a common goal and act in unity. It is easy to imagine that the intention content needs only to be satisfying to an individual for individual

intention. In the current study, we-intention seems to be a more appropriate concept for studying online social activities (e.g., to use instant messaging together).

2.2. Social influence processes

Prior studies have suggested that social influence is especially important in predicting the successful adoption and use of interactive communication technology (Bagozzi & Dholakia, 2002; Bagozzi, Dholakia, & Mookerjee, 2006; Bagozzi, Dholakia, & Pearo, 2007; Hsu & Lu, 2004; Koo et al., 2011; Shen et al., 2010). In particular, Kelman's social influence processes are often used as a theoretical base for developing knowledge in this area (Papadopoulos, Stamati, & Nopparuch, 2013). Kelman (1958) has distinguished three aspects social influence processes, including compliance, internalization and identification. Compliance occurs when an individual accepts the influence in order to get support, approval or a favorable reaction from people who have more power or status. Subjective norm in the Theory of Reasoned Action (Fishbein & Ajzen, 1975) is often used to reflect the influence of social normative compliance. Internalization occurs when an individual accepts information obtained from others as evidence about reality. Group norm, indicating the shared beliefs among group members, is often applied to describe social influence underlying internalization process (Bagozzi & Lee, 2002). Identification occurs when an individual accepts influence in order to establish and maintain a positive self-defining relationship with another person or group. Social identity is often employed in this regard (Bagozzi & Dholakia, 2006; Bagozzi & Lee, 2002; Shen, Lee, & Cheung, 2012). The three processes of social influence, in fact, play different roles depending on the circumstances.

Following the practice in prior studies, we have used subjective norm to represent social influence underlying the compliance process. Previous IS adoption and diffusion research has heavily examined the effect of subjective norm in adoption decision models. The results indicated that subjective norm functions only under conditions of mandatory use and for users with limited experience (Karahanna, Straub, & Chervany, 1999; Venkatesh et al., 2003). In the current study, the use of instant messaging is mostly a voluntary behavior for social or work-related communication, and people often have sufficient experience and knowledge on this medium. Therefore, it is expected that the effect of subject norm on we-intention will not be significant in this study.

H1 *(:). Subjective norm will not have any significant impact on we-intention to use instant messaging.*

The internalization process is represented in this study through the effect of group norm. Social influence underlying this process is captured by the congruence of the information obtained from others and one's own value system. In other words, group norm are shared values or goals perceived by the user between himself/herself and other group members. Prior studies have demonstrated that one's perceived similarity with other members will affect his/her participation intention in virtual community (Zhao, Lu, Wang, Chau, & Zhang, 2012). Studies on group action also consistently found that group norm significantly predicts we-intention (Bagozzi & Dholakia, 2002; Dholakia et al., 2004). In addition, Kelman (1958) suggested that if the values of the influencing agents are congruent with the recipients' own value systems, and the recipients believe the content of the behavior is intrinsically rewarding, and they tend to be willing to engage in the target behavior. In the current study, if an instant messaging user realizes that he/she shares one or more common goals or values with other users, he/she will be more likely to develop a we-intention to use this media together with others.

H2 *(:). Group norm will have a positive impact on we-intention to use instant messaging.*

Identification refers to one's self-conception in terms of thinking, feeling and acting on the basis of a "group level of self" (as a member of the group) instead of a "personal self" (Turner, 1987). The identification process is often characterized by social identity (Papadopoulos et al., 2013). Social identity arises through interaction with other users in the personal network as well as in online social networking groups (Bagozzi & Dholakia, 2006). It has been proven successful in predicting we-intention in online communities (Bagozzi & Dholakia, 2006; Shen et al., 2012). The underlying rationale is that social identity "*prescribes and instigates behaviors for the benefit of group members*" (Bagozzi et al., 2006, p. 102). In this study, social identity is expected to stimulate the collective acceptance and use of instant messaging because users are motivated to distinguish their own group from the out-groups (Zhao et al., 2012).

H3 *(:). Social identity will have a positive impact on we-intention to use instant messaging.*

2.3. Critical mass theory

Critical mass was originally defined as "*a small segment of the population that chooses to make big contributions to the collective action*" (Oliver, Marwell, & Teixeira, 1985, p. 524). It is often believed to provide the necessary conditions for cooperative and coordinative action to occur (Markus, 1987). This concept was later introduced into the innovation diffusion research and was defined as "*the point at which enough individuals have adopted an innovation so that the innovation's further rate of adoption becomes self-sustaining*" (Rogers, 1995, p. 313). Critical mass theory is particularly important in explaining the adoption and use of interactive communication media because the value of this sort of technology increases exponentially with the number of its users (Lou et al., 2000). In this regard, achieving a critical mass of active users will help accelerate the collective acceptance of interactive media (Slyke et al., 2007), improve users' contribution value (Zhao, Zhang, Wagner, & Chen, 2013), and reduce efforts required in social communication (Markus, 1987). Because the actual critical mass threshold of technology users is difficult, or sometimes impossible, to be measured, and an individual usually relies on his/her own perceptions to determine if the technology reaches the tipping point, prior studies often used perceived critical mass as a proxy to examine the critical mass effect (Lou et al., 2000). Although perceived critical mass has been consistently found as one of the most relevant and significant variables for predicting communication technology acceptance (Lou et al., 2000; Slyke et al., 2007), it cannot be regarded as identical with the original concept due to the fact that perceived critical mass depends on one's perception of whether an innovation gains a critical mass of users, and such perceptions may or may not reflect the actual critical mass. However, it is quite obvious that one's subjective perceptions of the critical mass of a communication innovation will influence his/her beliefs regarding the innovation, and the future adoption behavior.

In particular, previous research has established that perceived critical mass may affect information system usage intention both directly and indirectly. For example, a recent study has demonstrated that perceived critical mass strongly influence behavior intention to use 3G mobile service both directly and indirectly by changing the utilitarian and the normative beliefs surrounding this new technology (Cho, 2011). Similar findings also have been reported in prior instant messaging literature. Li, Chau, & Lou (2005) have found that perceived critical mass affects instant messaging usage intention directly and indirectly through perceived usefulness and perceived enjoyment, whereas the mediation effects are slightly stronger for Americans than for Chinese (Li et al., 2010).

Perceived critical mass also has been found to affect usage intention indirectly via attitude, perceived ease of use and the perceptions of the innovation characteristics (Hsu & Lu, 2004; Lu, Deng, & Wang, 2010; Slyke et al., 2007).

The idea of critical mass is central to many understandings of sustained collective action (Markus, 1987). Without a critical mass of regular participants, collective action cannot be successfully organized and performed. In this regard, ones's perception of a critical mass of participants provides the basis for the development of we-intention in this study. The value of social technologies, such as instant messaging largely relies on the number of its users and people often take others' actual usage behavior as the reason to adopt (Wattal, Racherla, & Mandviwalla, 2010). This fact is particularly true in small group communication and the simultaneous involvement of other in-group communication partners provokes his/her intention to act together (Li et al., 2005). Rogers (1995) also proposed that an individual will be more likely to adopt an innovation as the number of adopters in his/her personal network increases. In the current study, if an instant messaging user perceives that most of the in-group partners are using this technology for group project work, the individual may develop a we-intention that the group of peers will use instant messaging together in the future. Therefore,

H4 *(:). Perceived critical mass will have a positive impact on we-intention to use instant messaging.*

As we stated above, previous research has suggested the importance of social norm in groupware acceptance (Lou et al., 2000). In particular, perceived critical mass is believed to influence social norms through the direct and indirect interactions among technology users. This is because if there is a critical mass of users have adopted and used the system, the value of this technology will increase and it would be more beneficial for the users to engage in the system-related activities. This phenomenon is especially true for interactive and communication technologies (Markus, 1987). With the use of communication media, frequent interaction among the users thus will let them gradually perceive the norms from social groups. Prior studies on collective action and social networks also demonstrated that social interaction strengthens the relational ties, such as obligation and identification, between individuals and the network as a whole (Wasko, Faraj, & Teigland, 2004). In the current study, instant messaging provides an online discussion community, through which people can be involved in any topics they have an interest in. With more and more users start to flock to this technology, the intrinsic value of instant messaging-enabled groups/communities will become more apparent, and further make it more worthwhile for the users to engage in group communications and discussions. This would assist the users to understand and accept the prevailing norms within their social groups. In this study, we have chosen subject norm, group norm and social identity to reflect the social norms inherent in the use of instant messaging, and we will further discuss the influence of perceived critical mass on the social factors below.

As the use of instant messaging is mostly voluntary and the usage behavior is unlikely to be rewarded or punished, subjective norm, referring to what Kelman terms compliance, may not be significant in this study. In this regard, we primarily discuss the impacts of perceived critical mass on group norm and social identity. Group norm captures "*an understanding of, and a commitment by, the individual member to a set of goals, values, beliefs, and conventions shared with other group members*" (Dholakia et al., 2004, p. 245). It is often considered as the most readily accessible or inferable group-referent information. In the current study, if there is a critical mass of active instant messaging users in one's social or working groups, he or she may gradually understand and further accept the group norm through direct and indirect interaction with other users. In addition, if an individual perceives that most of in-group partners are using instant messaging, or these partners suggest the use of instant messaging, the individual may also believe that this technology can meet the group's goals or values. Therefore,

H5 *(:). Perceived critical mass will not have any significant impact on subjective norm concerning the use of instant messaging.*

H6 *(:). Perceived critical mass will have a positive impact on group norm regarding the use of instant messaging.*

Social identity captures an individual's identification with a group and can be achieved through self-awareness of one's membership, as well as the emotional and evaluative significance of this membership (Ellemers, Kortekaas, & Ouwerkerk, 1999). Prior studies have shown that identifying with a social group stems from an understanding of the benefits that comes with the membership (Dholakia et al., 2004). In this regard, if an individual perceives that most of the in-group co-workers are using instant messaging for group projects, such a critical mass of active adopters will demonstrate the membership benefits via direct and indirect social interactions. With the recognition of membership benefits and importance, an individual may want to belong to this group, and further will be more likely to develop a shared identity with the group. Therefore,

H7 *(:). Perceived critical mass will have a positive impact on social identity with the group.*

3. Research method

3.1. Data collection method

The data collection was conducted in a local university in Mainland China. The instant messaging platform we have examined in this study is QQ Group, which provides a shared online community for effective group project discussion. In particular, people with specific interests or experience can create an online group, and invite other like-minded people to participate in. Any one in the group can initiate a discussion by simply sending a messaging to the group. QQ Group is also very popular among Chinese youths, and therefore, university instructors often use this technology for organizing class project discussion. Students from six randomly selected classes were invited to participate in. A pencil-and-paper survey was used, and all participation in the survey was voluntary yet motivated by a lucky draw. Before the survey was administered, a short briefing was given to explain the purpose and the scenario of this study. A screening question was also used to identify respondents who have some prior experience in using QQ Group with their classmates for group project discussion. This study was introduced as an opinion survey. The respondents were asked to imagine in their mind the classmates they often discussed with through QQ Group. They were told to follow an instruction before filling out the questionnaire.

> "Imagine that you are logging on to the QQ Group to discuss class assignments or group project with the classmates you often collaborate with. Please picture briefly in your mind the name and image of each of these classmates in your project group. Then, write your nickname and their nicknames in the table below".

The instructions were designed to help respondents identify the people with whom they develop we-intentions to use instant messaging. They were also required to answer the questionnaire based on the group of classmates they identified before.

Table 1
Demographics of the respondents.

Sample characteristics	Number (N = 227)	Percentage (%)
Age		
<21	68	30.0%
21–25	125	55.1%
>25	34	14.9%
Gender		
Male	149	65.6%
Female	78	34.4%
Experience with instant messaging		
<2 Years	12	5.3%
2–5 Years	139	61.2%
>5 Years	76	33.5%
Time spent on instant messaging per day		
<1 h	51	22.5%
1–2 h	101	44.5%
>2 h	75	33.0%

3.2. Measures

The constructs of this study include we-intention, perceived critical mass subjective norm, group norm and social identity. All measures used in this study have been validated and used in prior studies with satisfactory reliability (see Appendix A). Minor changes in the wordings were made so as to fit into the current investigation of instant messaging. All constructs were measured with multi-item perceptual scales. Since the survey has been conducted in Mainland China, a backward translation method was used to ensure the consistency between the Chinese and the original English version of the questionnaire.

3.3. Survey responses

A total of 246 questionnaires were distributed, out of which 227 usable questionnaires were returned. Among the respondents, 149 were male and 78 were female. A majority (55.1%) of the respondents aged between 21 and 25. In general, the respondents were relatively experienced in using instant messaging and spent more than one hour on instant messaging per day. Table 1 provides the overall sample characteristics.

3.4. Common method bias

Since all data were self-reported and collected from a single source at the same time, we performed the Harman's single-factor test to assess common method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Multiple factors with eigenvalues greater than 1.0 emerged from the principal components factor analysis accounted for a large percent of the total variance. Meanwhile, the results also suggest that no single factor explained most of the variance, indicating that common method bias is not a serious threat in this study.

4. Results

LISREL 8.80 was used in the current investigation of instant messaging. LISREL is one of the most widely used Structural Equation Modeling (SEM) techniques in IS research. Following the two-step analytical procedures (Hair, Anderson, Tatham, & Black, 1998), the measurement model was first evaluated and the structural model was then assessed. The rationale of this two-step approach is to ensure our conclusion on structural relationships was drawn from a set of measurement instruments with desirable psychometric properties.

Table 2
Assessing the measurement model.

Goodness-of-fit measures	Recommended criteria	Fit indices
Chi-square/df	<3.0	3.39 (227.29/67)
GFI	>0.9	0.87
AGFI	>0.8	0.80
NFI	>0.9	0.91
CFI	>0.9	0.93
IFI	>0.9	0.93
RMR	<0.1	0.051

4.1. Measurement model

Goodness-of-fit criteria used for fitting the measurement models are shown in Table 2. Overall, the fit indices indicated acceptable fit of the model to the data. Although the value of Chi-square/df is 3.39 and the value of GFI is 0.87, some prior studies also have suggested that the acceptable cutoff values can be less than 5 for Chi-square/df and above 0.80 for GFI (Hsu & Lin, 2008; Jiang, Klein, & Carr, 2002).

To validate the measurement model, three types of validity (content validity, convergent validity and discriminant validity) were assessed. Content validity was first established by ensuring consistency between the measurement items and the extant literature. This was done by an extensive review of prior studies and pilot-testing the instruments.

Convergent validity indicates the extent to which the measuring items of a scale that are theoretically related should be related in reality. It was assessed by examining the item loadings, the composite reliability and the average variance extracted for all measures (Hair et al., 1998). Convergent validity can be demonstrated when all scale items loaded significantly on their hypothesized latent constructs. In addition, a composite reliability of 0.70 or above and an average variance extracted of more than 0.50 are deemed acceptable (Fornell & Larcker, 1981). Table 3 summarizes the item loadings, composite reliability, average variance extracted, Cronbach's alpha, mean, and standard deviation of the measures of all the constructs. The results indicated that all measures exceed the recommended thresholds, with composite reliability ranging from 0.78 to 0.88 and average variance extracted ranging from 0.55 to 0.78.

Table 3
Convergent validity.

Constructs	Item loadings	Mean	Std. deviation
We-intention (CR = 0.78, AVE = 0.64)		Cronbach's alpha = 0.779	
WE1	0.84	4.92	1.359
WE2	0.76	4.62	1.463
Subjective norm (CR = 0.88, AVE = 0.78)		Cronbach's alpha = 0.878	
SN1	0.89	4.56	1.563
SN2	0.87	4.55	1.526
Group norm (CR = 0.82, AVE = 0.70)		Cronbach's alpha = 0.809	
GN1	0.91	4.60	1.500
GN2	0.76	4.44	1.212
Social identity (CR = 0.88, AVE = 0.55)		Cronbach's alpha = 0.878	
SI1	0.64	4.78	1.294
SI2	0.74	4.51	1.169
SI3	0.79	4.56	1.262
SI4	0.78	4.52	1.380
SI5	0.74	4.47	1.396
SI6	0.75	4.46	1.446
Perceived critical mass (CR = 0.80, AVE = 0.66)		Cronbach's alpha = 0.794	
PCM1	0.84	5.33	1.399
PCM2	0.79	5.27	1.453

Note: CR, composite reliability; AVE, average variance extracted.

Table 4
Confirmatory factor analysis.

	We-intention	Subjective norm	Group norm	Social identity	Perceived critical mass
W1	**0.916**	0.138	0.409	0.445	0.405
W2	**0.895**	0.016	0.343	0.403	0.396
SN1	0.084	**0.953**	0.056	0.119	0.074
SN2	0.083	**0.934**	0.024	0.115	0.047
GN1	0.414	0.065	**0.931**	0.468	0.232
GN2	0.350	0.013	**0.909**	0.377	0.224
SI1	0.233	0.160	0.276	**0.693**	0.241
SI2	0.351	0.037	0.317	**0.802**	0.373
SI3	0.415	0.173	0.429	**0.828**	0.366
SI4	0.421	0.078	0.384	**0.820**	0.336
SI5	0.380	0.082	0.373	**0.787**	0.331
SI6	0.377	0.076	0.390	**0.800**	0.270
PCM1	0.370	0.059	0.209	0.429	**0.913**
PCM2	0.436	0.060	0.242	0.316	**0.909**

Table 5
Correlation matrix of the constructs.

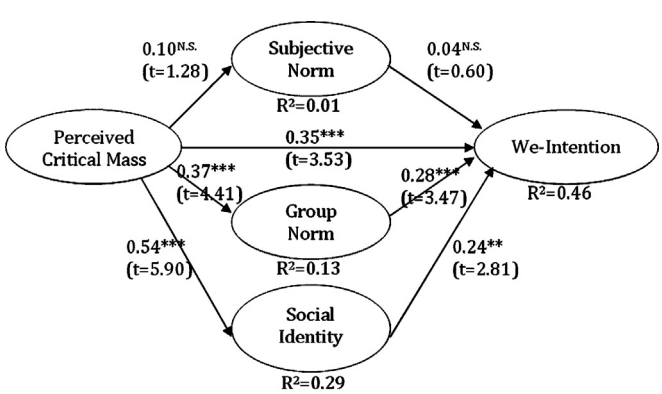
	We-intention	Subjective norm	Group norm	Social identity	Perceived critical mass
WE	**0.80**				
SN	0.12	**0.88**			
GN	0.52	0.06	**0.84**		
SI	0.56	0.14	0.54	**0.74**	
PCM	0.55	0.08	0.29	0.50	**0.81**

Note: The bold numbers in the diagonal row are square roots of the average variance extracted.

Discriminant validity represents the extent to which a given construct differs from other constructs. Gefen and Straub (2005) suggested that discriminant validity is shown when the measurement items load highly on their theoretically assigned factor and not highly on other factors, and the square root of the average variance extracted for each construct should be greater than the correlations between that construct and all other constructs. Table 4 presents the confirmatory factor analysis results. Table 5 shows the correlation matrix of the constructs and the square roots of the average variance extracted for each construct. Finally, the results suggested an adequate discriminant validity of the measures used in the current study.

4.2. Structural model

The model was estimated using maximum likelihood method. Fig. 2 depicts the overall explanatory power, the estimated path coefficients (all significant paths are indicated with asterisks), and



N.S.-not significant; *p<0.05; **p<0.01; ***p<0.001.

Fig. 2. Structural model.

Table 6
Assessing the structural model.

Goodness-of-fit measures	Recommended criteria	Fit indices
Chi-square/df	<3.0	3.75 (262.46/70)
GFI	>0.9	0.86
AGFI	>0.8	0.79
NFI	>0.9	0.89
CFI	>0.9	0.92
IFI	>0.9	0.92
RMR	<0.1	0.093

the associated *t*-value of the paths. The fit statistics in Table 6 indicate that the research model provides an acceptable fit to the data.

In addition, the model accounts for 46% of the variance in we-intention to use instant messaging, 29% of the variance in social identity and 13% of the variance in group norm. The results indicate that perceived critical mass has the strongest impact on we-intention, with a path coefficient at 0.35, followed by group norm and social identity, with path coefficients at 0.28 and 0.24 respectively. Except for the direct effect, perceived critical mass also exerts statistically significant indirect effect on we-intention via social identity and group norm, with path coefficients at 0.54 and 0.37 respectively. As we hypothesized, subjective norm does not play any significant role in the current investigation context. Table 7 summarizes the results of all tested hypotheses.

5. Discussion and conclusion

The popularity and penetration of Web 2.0 applications have greatly changed the way in which people communicate in today's world. In particular, instant messaging has been gradually becoming a major communication media for both social and business purposes. Some recent research has already started to address the issue regarding social media and investigated the determinants of adoption intention. However, most of the studies still employed the traditional individual-intention-based models to examine this new and complex phenomenon. This study builds on the work of Bagozzi (2007) to advance our current understanding of system

Table 7
Model testing results.

Hypotheses	β	p	Supported?
H1: Subjective norm → We-intention (no effect)	0.04	N/A	Supported
H2: Group norm → We-intention (+)	0.28	$p < 0.01$	Supported
H3: Social identity → We-intention (+)	0.24	$p < 0.01$	Supported
H4: Perceived critical mass → We-intention (+)	0.35	$p < 0.01$	Supported
H5: Perceived critical mass → Subjective norm (no effect)	0.10	N/A	Supported
H6: Perceived critical mass → Group norm (+)	0.37	$p < 0.01$	Supported
H7: Perceived critical mass → Social identity (+)	0.54	$p < 0.01$	Supported

Note: β is the standardized path coefficient.

usage intention, beyond the commonly used individual (personal) intention. Specifically, this study views the collective acceptance and use of instant messaging as an intentional social action and adopts the concept of "we-intention" as the major issue of interest. In addition, this study develops a research model with a specific focus on the collective intentionality. Perceived critical mass is regarded as the essential basis for the development of we-intention, which in fact conceptually takes all group members' usage behaviors into account.

5.1. Discussion of key findings

The three types of social influence processes, except for subjective norm, are significant antecedents of we-intention to adopt and use instant messaging. In this regard, users who have similar values or goals with other participants and these who categorize themselves as group members are more likely to develop we-intentions to use instant messaging. This finding is also consistent with previous studies investigating the impact of social influence in virtual community participation (Bagozzi & Dholakia, 2002; Bagozzi et al., 2006). The insignificance of subjective norm in the current investigation context, as we stated above, should be due to the fact that compliance functions only under conditions of mandatory use and for users with limited experience. As we expected, perceived critical mass plays significantly in this model. The results indicated that perceived critical mass influences we-intention to use instant messaging both directly and indirectly through group norm and social identity. In this sense, our findings provide an additional empirical support to the impact of perceived critical mass on IS innovation adoption and diffusion (Lou et al., 2000).

5.2. Limitations and future research

Before highlighting the implications for research and practice, the limitations of this study are first addressed. First of all, the data was collected from a convenience sample (student groups) with instant messaging usage experience. In this particular context, we-intention is developed when students use instant messaging for in-group project discussion, which may be different in nature from that conducted in social or business contexts, or using other social technologies, such as wiki or blog. Although university students represent the future workforce and instant messaging is one of the most popular social media platforms, generalization of the findings should be made with caution. Second, we have not considered the actual instant messaging usage behavior in the current study. The effectiveness and ability of we-intention, as compared to individual intention, in predicting users' actual behavior is obviously an important and challenging area requiring more attention in future research. A longitudinal study thus is highly recommended on this topic. Third, this study was conducted in Mainland China, which belongs to collectivistic culture. In this regard, culture may bias the development of we-intention in this study. This is because people from collectivistic culture tend to be affected by social influence more often than people who belong to an individualistic culture. Future cross-cultural studies should further examine these issues. Fourth, most of the constructs in this study have only two measurement items. Although all the measures were adapted from those validated and used in prior research with satisfactory reliability and it is reasonable to use two measurement items for constructs that are conceptually straightforward and simple, we still suggested future research considering measurement with three or more items when conducting similar studies. Finally, although our research model accounts for 46% of the variance in we-intention, some important variables may be missing here. In particular, we have placed a greater emphasis on social factors but neglected factors, such as perceived usefulness and system/website usability, which were widely examined in prior individual intention-based models. Future research should extend this line of inquiry and incorporate additional factors from cognitive and affective perspectives to improve the quality of the research model and thus its predictive ability.

5.3. Implications for research

This study contributes to existing research on adoption decision models in two important ways. First, previous studies on technology acceptance primarily followed the individual intention approach, which refers to an individual makes his/her own decision to adopt a new technology. However, the adoption and use of social media cannot be successfully undertaken unless a group of individuals are willing to use the technology together. In this regard, decision to adopt and use social technologies, such as instant messaging in this study, represents a social phenomenon that largely depends on the collective efforts by its users. With the use of social technology, people will be influenced not only by their own perceptions toward the system, but also by the actions simultaneously taken by their peers. The collective acceptance behavior thus requires shared responsibility, as well as decision interdependence among two or more people. As an active attempt to unveil the collective intention involved in social media adoption, this study explores the intentional social action in the context of instant messaging and examines the relatively new concept of "we-intention". This study is expected to bring additional insights into our field and contribute to IS innovation and diffusion literature by providing some fresh perspectives toward intention-based models. In addition, it also offers an opportunity for future research to investigate intentional social actions emerging in recent popular Web 2.0 websites, such as Facebook, Groupon, Twitter, SecondLife, Foursquare, Quora, etc.

Second, this study also advances the theoretical and empirical understanding of the role of perceived critical mass in explaining acceptance and use of social media. Prior studies in this area have found that perceived critical mass has an indirect effect on innovation adoption intention through users' perceptions toward the technology itself, including perceived usefulness, perceived ease of use (Lou et al., 2000), perceived innovation characteristics (Slyke et al., 2007) and perceived enjoyment (Li et al., 2010). The results of this study provide some interesting ideas into the theoretical work with perceived critical mass. It is shown that group norm and social identity are two most important mechanisms through which perceived critical mass exerts an effect on system adoption intention. In this regard, this study contributes to the existing literature on critical mass theory by clearly demonstrating the underlying social influence mechanisms. In addition, perceived critical mass is also particular important for we-intention-based models because a critical mass of users is a prerequisite for we-intention to develop. Future studies should continue to investigate

the underlying mechanisms through which perceived critical mass leads to the collective acceptance of social technology.

5.4. Implications for practice

The results of this study also provide some useful insights to practitioners. Based on the findings of this study, here are some guidelines for the collective use of instant messaging. First, group norm and social identity play important roles in determining we-intention to adopt and use instant messaging. Therefore, people with common values or goals and people who have shared identity will tend to use instant messaging collectively. In this regard, community managers should encourage interactions among group members to deepen their understandings of the group norm and also increase their belongingness to the community. In particular, some practical recommendations include making the group norm explicit through public files such as FAQs or bulletins, providing opportunities for routine group discussion, and building a satisfying relationship among all group members. In addition, managers can make good use of some special features of instant messaging, such as chat rooms or grouping function to help achieve shared goals/values and further facilitate identification with the community as a whole.

Second, the significant effect of perceived critical mass also provides some important practical implications for community managers. According to the findings of this study, achieving a critical mass of users is essential for the successful implementation of instant messaging. Managers therefore should consciously encourage the collective use of instant messaging among group members in order to reach a critical mass of early active users. In this sense, some practical suggestions include targeting groups where members have close personal relationships with each other, encouraging word-of-mouth communication among early users and potential users, and making the early adopters more visible to the majority. In addition, users' perceptions of critical mass are heavily influenced by the acceptance of this technology within the visible and relevant sub-networks. Therefore, managers should try to promote the use of instant messaging in a visible sub-group first. This will further convey an overall impression to other group members and sub-networks that critical mass has been achieved.

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Appendix A. Survey Items

We-intention (adapted from Dholakia et al., 2004)

WE1 I intend that our group use instant messaging for team collaboration together sometime during the next two weeks (7-point "disagree-agree" scale).

WE2 We intend to use instant messaging for team collaboration together sometime during the next two weeks (7-point "disagree-agree" scale).

Subjective norm (adapted from Bagozzi & Lee, 2002)

SN1 Most people who are important to me think that I should/should not use instant messaging for team collaboration during the next two weeks (7-point "should-should not" scale).

SN2 Most people who are important to me would approve/disapprove of me using instant messaging for team collaboration during the next two weeks (7-point "approve-disapprove" scale).

Group norm (adapted from Bagozzi & Lee, 2002)

Using instant messaging for team collaboration sometime during the next two weeks with the group members you often collaborated with can be considered as a goal. For each member in your group, please estimate the strength to which each holds the goal (7-point "weak-strong" scale).

GN1 Strength of the shared goal by the self.

GN2 Average of the strength of the shared goal for other members.

Social identity (adapted from Bagozzi & Lee, 2002)

SI1 How would you express the degree of overlapping between your own personal identity and the identity of the group you collaborate with through instant messaging when you are actually part of the group and engaging in group activities? (8-point "far apart-complete overlap" scale).

SI2 Please indicate to what degree your self-image overlaps with the identity of the group of partners as you perceive it (7-point "not at all-very much" scale).

SI3 How attached are you to the group you collaborate with through instant messaging? (7-point "not at all-very much" scale)

SI4 How strong would you say your feelings of belongingness are toward the group? (7-point "not at all-very much" scale)

SI5 I am a valuable member of the group (7-point "does not describe me at all-describe me very well" scale).

SI6 I am an important member of the group (7-point "does not describe me at all-describe me very well" scale).

Perceived critical mass (adapted from Lou et al., 2000)

PCM1 Most students in my class used instant messaging for team collaboration frequently (7-point "disagree-agree" scale).

PCM2 Most students in my group used instant messaging for team collaboration frequently (7-point "disagree-agree" scale).

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