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Abstract

Purpose – The purpose of this paper is to develop a research model examining users' perceived needs-technology fit of mobile communication software through motivational needs and technological characteristics. The study investigated the effects of perceived needs-technology fit on user satisfaction and intention to continue using mobile communication software.

Design/methodology/approach – This study proposes a research model based on task-technology fit theory and uses and gratification theory, incorporating key determinants of users' continuance intention toward mobile communication software. An online survey instrument was developed to collect data, and 403 questionnaires were used to test the relationships in the proposed model.

Findings – The causal model was validated using AMOS 21.0, and all nine study hypotheses were supported. The results indicated that users' perceived needs-technology fit and satisfaction were crucial antecedents of their intention to continue using mobile communication software and that they mediated the influence of users' needs as well as technological characteristics.

Practical implications – Mobile communication software practitioners should focus on enhancing users' perceived needs-technology fit through motivational needs (utilitarian, hedonic, and social needs) and technological characteristics (mobile convenience, service compatibility, and user control) to further boost user satisfaction and intention to continue using mobile communication software services.

Originality/value – This study contributes to a theoretical understanding of factors explaining users' continuance intention toward mobile communication software.

Keywords Continuance intention to use, Mobile communication software,
Perceived needs-technology fit, Technology characteristics, User's satisfaction

Paper type Research paper

Introduction

In recent years, instant messengers (IMs) have infiltrated people's daily lives at a remarkable rate, becoming a vital medium for conveying messages and communicating among people (Lin and Chiu, 2011); Yahoo Messenger and MSN Messenger are successful examples of such IMs (Lin and Bhattacherjee, 2008). Moreover, people's communication methods keep changing with the maturation of wireless communication technology and the prevalence of smart mobile carriers, in which the IMs on desktop computers are gradually being substituted with mobile instant messengers (MIMs) such as WhatsAPP, LINE, and WeChat (Schadler *et al.*, 2014).

Early instant communication software provided functions dominated by texts while supporting users' activities of sending/receiving photos or files, expressing their moods through symbols, and making calls. However, when mobile application providers develop instant communication software specifically for mobile carriers, subscribers of such carriers can download such software to their mobile devices running operating

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systems such as iOS, Android, Symbian, and Windows. Mobile instant communication not only enables users to communicate in a more instant manner but also provides diverse services such as file or photo sharing, voice talk, group chat, video talk, photo editing tools, games, additional dynamic messages, and personal weblogs (Hong *et al.*, 2013; Oghuma *et al.*, 2015, 2016). Considering the new form of services engendered by mobile instant communication, the early instant communication services cannot meet user demands; this is because mobile instant communication has changed into an information service platform suitable for pleasure, commerce, and work. Mobile instant communication is thus popular among smartphone users as an essential medium through which they can realize regular daily contact (Oghuma *et al.*, 2015, 2016).

In the information system literature discussing people's usage behaviors, two theories are widely applied (Oghuma *et al.*, 2016), namely, the technology acceptance model (TAM; Davis, 1989) and unified theory of acceptance and use of technology (UTAUT; Venkatesh *et al.*, 2003). These theories demonstrate that it is possible to predict users' intention to use an information system in terms of their attitude, and they consider that external factors (e.g. perceived usefulness and perceived ease of use) affect people's attitude toward use in addition to influencing their usage behaviors. According to Bagozzi (2007), the theoretical basis of the TAM is both concise and conceptually accurate, and this model has thus been widely used in documents on information systems to explain why people use information technology. He also revealed its limitation to be its over-simplified constructs for explaining people's behaviors. The UTAUT, which extends the concept of the TAM, provides a more sensible model to explain users' usage behaviors (Venkatesh *et al.*, 2003). Lu and Yang (2014) considered the UTAUT as a wider theoretical model, albeit with limitations because it does not consider the characteristics of technology. They further stated that neither the TAM nor the UTAUT is sufficient to predict users' behavior intention in the context of social media; they thus asserted, on the basis of the theory of task-technology fit (TTF), that the fit among task, technology, and users would affect users' conception and faith, of which fait affects users' behavior of using social media.

Several researchers (Hong *et al.*, 2013; Oghuma *et al.*, 2015, 2016) have argued that mobile instant communication is a new form of social media service application, and that the factors affecting people's use of mobile instant communication are consequently more complicated than those affecting their use of conventional information technology; this is because mobile instant communication is not only a task-oriented (utilitarian) information technology but also a pleasure-cum-social-oriented one. Studies on social media conducted in recent years have tended to incorporate the viewpoint of TTF into the research context. Some researchers (Kwai Fun IP and Wagner, 2008; Lu and Yang, 2014) have verified that TTF directly affects users' acceptance for and use of social media. Moreover, from the viewpoint of use and satisfaction theory, whether a user's motive is satisfied is a crucial factor influencing his or her attitude toward using the media (Ko *et al.*, 2005; Wei *et al.*, 2015). Kwai Fun IP and Wagner (2008) argued that regarding users' behavior of choosing social media, it is necessary to explore the fit between users' motivational needs and information technology characteristics from the perspectives of these two factors. As such, this study considers that the services of mobile communication software must satisfy users' needs and that the technological characteristic of such software and users' needs should also have a fit to enhance user satisfaction and stimulate user continual usage. Furthermore, studies on MIMs (Oghuma *et al.*, 2015, 2016) have found that satisfaction played a considerable role in keeping customers and stimulating them to use products or services again. On the basis of the

preceding discussions, by employing TTF and use and satisfaction theory as the basis and adopting the perspective of user needs and technological characteristics (Goodhue and Thompson, 1995; Kwai Fun IP and Wagner, 2008; Wei *et al.*, 2015), we propose an integrated research model called "perceived needs-technology fit" to explore the factors affecting users' continued use of mobile communication software. Through this study, the following relevant questions were answered:

RQ1. What are the key motivational needs and technological characteristic factors of MIM that lead to user's perceived needs-technology fit?

RQ2. What is the key factor affecting continuance intention to use MIMs?

The rest of this paper is organized as follows. Second section provides a brief overview of the TTF model, and third section describes the research model and study hypotheses. Fourth section presents the methodology for participant enrollment and data collection and instrument development. The experimental results are explained in fifth section. Conclusions, implications, and limitations and future research directions are provided in the final section.

Theoretical background

TTF

TTF was proposed by Goodhue and Thompson (1995), who considered that technologies are used only when their functions meet the need of tasks. The core construct of the TTF model is the fit between task and technology, which Goodhue and Thompson (1995) defined as the extent to which the technology helps a person to accomplish certain tasks. It further explores the fit among technology, task, and users, considering that if the information technology supports the needs of users' tasks, it is used and further increases the users' work performance. Moreover, several researchers (Klopping and Mckinney, 2004; Lin, 2012; Lu and Yang, 2014; Yen *et al.*, 2010) have stated that information technology drives users to actively use it only when its functional features meet the needs of their task. From the perspective of user cognition, the fit between the characteristics of tasks and technology is the key factor directly affecting the intention to use an information technology and its efficacy as well as the task performance. This indicates that the extent of the fit among task, technology, and user affects users' task performance and cognized faith, which in turn affects their behavior of using the technology.

In the past, TTF was mostly used to explore the performance of information systems within corporations, investigating the characteristics of employees' tasks as well as those of such systems; therefore, its framework has not been applied to other realms or to exploring individuals. However, by considering users as individuals, several researchers (Klopping and Mckinney, 2004; Lin, 2012; Yen *et al.*, 2010) have recently adopted TTF as a theoretical basis to explore the usage behaviors of users or have applied it to other fields. For instance, Klopping and Mckinney (2004) proposed a model combining TTF and TAM for exploring consumer shopping behaviors in e-commerce; they determined that TTF exerted direct, positive, and significant effects on the usage behaviors and intention. Lin (2012) considered that the fit of a virtual learning system cognized by users influenced their satisfaction with and continuance intention to use the system as well as the positive learning effectiveness of the system. By using TTF, Yen *et al.* (2010) investigated the factors affecting users' acceptance of wireless technology (e.g. wireless carriers like mobile phones and

laptop computers), and the results indicated that the extent of the fit between the task and technology affected whether users used the wireless technology carriers. Zhou *et al.* integrated the TTF and UTAUT frameworks to explore users' intention to use mobile banking, and their findings revealed TTF as the key factor affecting users' acceptance.

The TTF model has been applied to research on social media. Lu and Yang (2014) proposed a social-technology fit model based on TTF to predict the usage behaviors of social networking website users. They discovered that social-oriented needs exerted a greater influence on the usage intention of Facebook users, compared with task-oriented needs. To study how a fit between blog technology and social network users' social needs influences the usage behaviors of such users, Kwai Fun IP and Wagner (2008) adopted bloggers' social needs (rather than task motives) and proposed a new needs-technology fit model as their research framework. Their findings demonstrated that the existence of a fit between bloggers' needs and the technological characteristics enhanced the bloggers' usage behaviors. The described literature reveals that TTF is considered an essential theory in terms of exploring the factors influencing people's behavior of using social media (Kwai Fun IP and Wagner, 2008; Lu and Yang, 2014). Hence, the current study adopted TTF as a theoretical framework to explore the factors influencing users' intention to continue using mobile instant communication.

Motivational needs

Katz *et al.* (1974) first proposed uses and gratification theory in their work entitled "On the use of the mass media for important things" (Rosengren *et al.*, 1985). To date, this theory has been widely applied by many researchers in explaining the patterns of individual behaviors and verifying theories, and it has served as the basis in several studies that have extended it into various research models (Ko *et al.*, 2005; Raacke and Bonds-Raacke, 2008; Wei *et al.*, 2015). Uses and gratification theory explicates the psychological motivations of an audience to actively use media, where the motivations induce members of the audience to selectively use certain media to satisfy their psychological needs. The theory also has a basic hypothesis that emphasizes the audience's use of the media for certain purposes and in an active manner, where each member of the audience knows his or her needs. Stafford *et al.* (2004) stated that users realize their needs and choose the appropriate media to satisfy their corresponding motives. Therefore, whether users' motives are satisfied is a critical factor affecting their attitude toward using the media (Ko *et al.*, 2005; Wei *et al.*, 2015). Numerous researchers (Ko *et al.*, 2005; Raacke and Bonds-Raacke, 2008; Wei *et al.*, 2015) have also discovered that users' motives of need affect their decision in using information technology.

Technological characteristics

In a study of the use of products or services, Rogers (1995) used the perceived innovative characteristic of information technology to explain the process associated with the use of products or services. He stated that relative advantage, compatibility, complexity, observability, and trialability are key characteristics affecting a person's cognition of technology (Rogers, 1995). However, research on information systems (Agarwal and Prasad, 1998; Kleijnen *et al.*, 2007) has revealed that only relative advantage, compatibility, and complexity exhibit a considerable and consistent correlation to products or services. Lin and Lu (2015) used these three characteristics as

mobile technology variables, discovering that they are the key features of mobile technology. Therefore, the current study also applied these three characteristics as predictor variables for the characteristics of MIMs.

The main feature of mobile value-added services is the ability to use mobile communication software at any time and place. Referring to studies on mobile businesses (Kleijnen *et al.*, 2007; Lin and Lu, 2015), we used mobile convenience to measure the advantage of using MIMs through mobile carriers. Compatibility also emphasizes how a mobile value-added service and consumer needs fit (Kleijnen *et al.*, 2007), we used service compatibility to express the construct of compatibility proposed by Rogers (1995). Complexity, the perceived extent to which a product or service is difficult to understand or use, negatively affects the spread of innovative technology (Rogers, 1995). Hence, if users perceive using a mobile value-added service as complicated, they must expend efforts in learning to use it (Kleijnen *et al.*, 2007). We thus employed user control to express the complexity proposed by Rogers (1995); in short, we used mobile convenience, service compatibility, and user control as the constructs of technological characteristics to predict users' cognition of MIMs.

Research model and hypotheses

Figure 1 illustrates our model, which is based on TTF and related literature. The definition and hypothesis of each construct of the model are explicated in the following subsections.

Perceived needs-technology fit

Several researchers (Kwai Fun IP and Wagner, 2008; Lin, 2012; Yen *et al.*, 2010) have stated that TTF theory is a crucial theoretical framework for explaining a user's behavior when using information technology. Among them, Kwai Fun IP and Wagner (2008) determined that user needs are one of the key factors affecting the use of

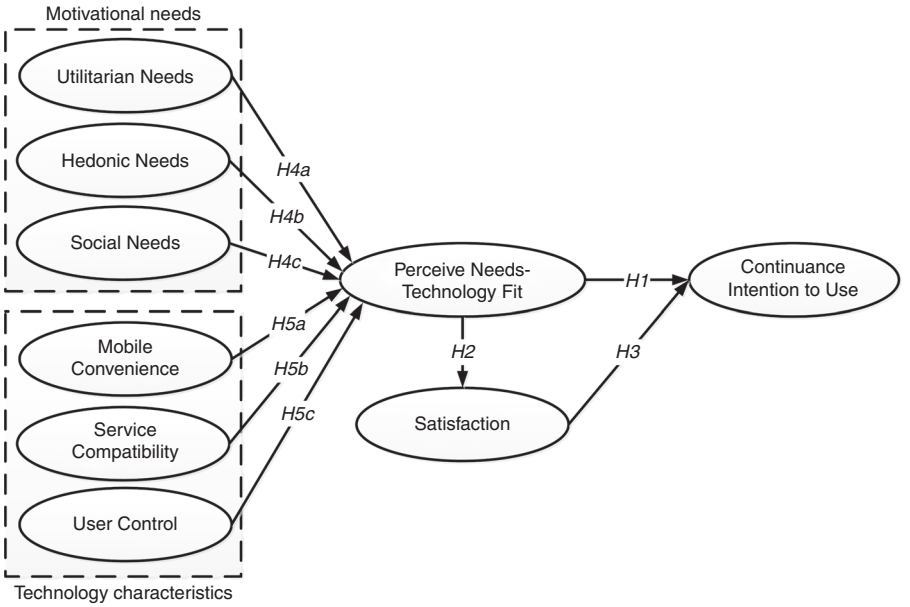

Figure 1.
Research model

information technology; therefore, they substituted task motivation with user needs and proposed a needs-technology fit model as a research framework. They observed that when technological characteristics fit users' need for using information technology, the possibility of using information technology is greater. Lin (2012) constructed a research framework by applying TTF theory and found that when a system is used, the perceived information technology fit significantly influences users' satisfaction and their behavioral intention to continue using the system.

From the aforementioned studies, it is clear that motivational needs arise in people who want to satisfy their needs, and the fit between information technological characteristics and user needs influences users' behavioral intention to continue using a technology as well as their satisfaction. We thus consider that when users perceive a good fit between their needs and the technological characteristics of MIMs (e.g. LINE), their behavioral intention to continue using the technology as well as their satisfaction are increased; this perception leads to the behavioral intention to continue using the technology and enhanced user satisfaction. Therefore, we proposed the following hypotheses:

H1. Perceived needs-technology fit positively affects user intention to continue using MIMs.

H2. Perceived needs-technology fit positively affects user satisfaction.

Satisfaction

Satisfaction arises from perceived positive feelings about the characteristics or results of product functions (Lin, 2012; Lu *et al.*, 2010). Many studies on information systems and e-commerce (Lin, 2012; Oghuma *et al.*, 2015, 2016; Zo *et al.*, 2013) have discovered that satisfaction plays a considerably integral role in retaining customers and stimulating them to use the products or services again. Specifically, if information technology users are satisfied with the technology, they continue using it. Oghuma *et al.* (2015, 2016) have also found that in the context of MIMs, users' satisfaction affects their continuance intention. Combining the aforementioned viewpoints, we considered users' satisfaction with mobile communication software as one of the factors influencing their behavioral intention to continue using such software. Therefore, we proposed the following hypothesis:

H3. Satisfaction positively affects users' intention to continue using MIMs.

Motivational needs (utilitarian, hedonic, and social needs)

Studies (Katz *et al.*, 1974; Ko *et al.*, 2005; Stafford *et al.*, 2004; Raacke and Bonds-Raacke, 2008) have revealed that people realize their own needs and choose appropriate media to meet their motives of need.

Lu and Yang (2014) stated that users' needs for social networking sites are task oriented or social oriented. Raacke and Bonds-Raacke (2008) investigated social networking websites and found that users' motives for using such websites can be divided in two types: the need for friends (social need) and need for information (utilitarian need), in which they consider such websites as sources of information. They further stated that these two types of motivational need influence users' attitudes toward social networking websites. On the basis of this statement, Wei *et al.* (2015) divided users' motivational needs into informational need (external motive) and social

need (internal motive), and their finding revealed that the social need positively affected users' attitude.

We considered that mobile communication software systems (e.g. LINE) provide functions of instant communication and built-in image posting tools as well as functions like games, entertainments, and social networking. We thus considered that for users, mobile communication software systems are not only task-oriented (utilitarian) and pleasure-oriented (hedonic) information systems but also social-oriented (social) information systems. As such, we proposed three motives of need, namely, utilitarian, hedonic, and social needs, as the components of motivational needs for mobile communication systems. Kwai Fun IP and Wagner (2008) proposed a needs-technology fit model to explore the behaviors of information technology users, and their findings demonstrated that users' needs affected their perception of the needs-technology fit. By combining the preceding findings, we proposed the following hypothesis:

H4a-c. (a) Utilitarian motivational needs; (b) hedonic motivational needs; and (c) social motivational needs positively affect users' perceived needs-technology fit.

Technological characteristics

Mobile convenience. Lin and Lu (2015) stated that mobile devices (e.g. smartphones) enable using real-time and convenient services. Mobile devices are referred to as any time, any place, and always on personal devices (Kim and Hwang, 2010; Seo *et al.*, 2013). Specifically, users can use their mobile phones to gather information and conduct transactions at any time and place (Kim and Hwang, 2010). Moreover, with an effective and real-time service transmission, users can use mobile value-added services on their mobile phones (Kleijnen *et al.*, 2007). We considered that users can download, install, and run MIMs (e.g. LINE) through their mobile devices and that the convenience engendered by the ability to use mobile devices at any time and place can enable users to perform activities such as sending messages and photos, using drawing tools, playing games, sending dynamic messages, creating personal microblogs, and satisfying their needs in real time. Therefore, we proposed the following hypothesis:

H5a. Mobile convenience positively affects users' perceived needs-technology fit.

Service compatibility

Meuter *et al.* (2005) argued that compatibility is the extent to which a product is consistent with a consumer's value and lifestyle. The concept of compatibility has also been applied to studies on the use of mobile technology (Kleijnen *et al.*, 2007; Lin and Lu, 2015). Consumers use mobile value-added services mainly to satisfy specific service needs (Kleijnen *et al.*, 2007); therefore, when such services are compatible with user needs, service compatibility exists (Lin and Lu, 2015).

Service compatibility emphasizes the consistency of a mobile value-added service with a consumer's service needs (Kleijnen *et al.*, 2007). Lin and Lu (2015) stated that with the ability to use social networking websites on smartphones, users are not restricted to using a PC to write and send messages, read their friends' latest posts, or update their status. Therefore, we considered that when users use MIM through smartphones, they can use services such as instant communication and games.

Moreover, when users perceive that using MIMs (e.g. mobile LINE) can enable them to enjoy the technology features that they would experience on a PC, their service needs are satisfied. Therefore, the following hypothesis was proposed:

H5b. Service compatibility positively affects users' perceived needs-technology fit.

User control

Complexity refers to the extent to which a product or service is perceived as difficult to understand or use (Rogers, 1995). Kleijnen *et al.* (2007) defined complexity as the degree of difficulty faced by users in learning about specific operating procedures before using a technology or mobile device.

Lin and Lu (2015) stated that an information technology that requires users to expend more effort to learn and operate it is associated with highly negative effects. Davis (1989) proposed a TAM and found that a user's perceived ease of use of a product or service affects the user's attitude and reflects the complexity of the product characteristics. Taylor and Todd (1995) stated that the perceived ease of use can be negatively analogous to the complexity. Flavián *et al.* (2006) stated that the ease of use of a system implies that users can understand the structure, interface, functions, and contents of the system. Specifically, if users can understand the system operation easily, use the initial contents of the website effortlessly, and find the information they need quickly, then they can comprehend the system, the time required to browse the website, and the perceived ease of use for executing necessary actions, enabling them to clearly determine their position. Accordingly, we considered that if a user can operate the functions of an MIM (e.g. mobile LINE) without the necessity of operating multiple interfaces and if the user can control the services of the MIM, then the control of the MIM is satisfactory; furthermore, the user's needs are satisfied. Therefore, the following hypothesis was proposed:

H5c. User control positively affects user's perceived needs-technology fit.

Research methodology

Participants and data collection

The targeted participants were active or previous users of mobile LINE services in Taiwan, currently the most popular MIM in Taiwan according to i-BUZZ Research (2014). The official LINE website stated that as of October 2014, LINE had 560 million users worldwide since its launch in June 2011. With the rapid increase in the number of its users, LINE has become the world's sixth-largest mobile communication software. Moreover, according to i-BUZZ Research (2014), in August 2014, the number of LINE users in Taiwan reached 17 million. LINE is currently the number-one ranking mobile communication software on the list of APP downloads in Taiwan. Therefore, we selected it as the subject software system for this study.

Empirical data for this study were collected through online questionnaires. Invitation messages highlighting the survey goals were posted for 56 days on high-traffic websites such as Sogi (www.sogi.com.tw) and online communities such as Mobile01 (www.mobile01.com) and Facebook (www.facebook.com); a hyperlink to the survey form was also posted along with the messages. To increase the response rate, we offered respondents who fully completed the questionnaire the opportunity to participate in a lucky draw to win 1 of 120 NT$100 bookstore vouchers. To avoid duplicate responses, respondent identity was confirmed using the e-mail and IP addresses obtained upon questionnaire retrieval. The final online survey yielded 403

respondents with valid responses. Of these, 51.7 percent were males, and most of the respondents were aged 20-29 years. Table I presents a summary of the demographics of the respondents.

Instrument development

To ensure content validity, the items selected for the constructs were mainly adopted from previous studies. The selected items were slightly modified to fit the MIM context. Items measuring needs, namely, utilitarian, hedonic, and social needs, were adapted from the studies of Zhou *et al.* (2014) and Wei *et al.* (2015), respectively. In addition, items measuring technological characteristics such as mobile convenience, service compatibility, and user control were adopted from the study of Lin and Lu (2015). A measure of perceived needs-technology fit was adapted from Oliveira *et al.* (2014). Satisfaction was assessed using items developed by Lu *et al.* (2010). Finally, items measuring continuance intention were developed on the basis of the study by Davis (1989). All items were measured using a five-point Likert-type scale with anchors ranging from 1 (strongly disagree) to 5 (strongly agree).

A pretest and pilot test were used to validate the model and instrument. The pretest involved six respondents, each with more than four years of experience using mobile communication software services. The respondents commented on the length of the instrument, format, and wording of the scales. In the pilot test, 50 smartphone users validated the instrument. The wording in both tests was slightly modified, and the Appendix presents the final questionnaire items.

Measure	Item	Frequency	%
Gender	Female	195	48.3
	Male	208	51.7
Age (years)	Under 19	23	5.7
	20-29	147	36.5
	30-39	134	33.3
	40-49	67	16.6
	Over 50	32	7.9
Education	High school or less	69	17.1
	College/university	221	54.8
	Graduate degree	113	28.1
Occupation	Student	167	41.4
	Office worker	188	46.7
	Self-employment	23	5.7
	Home marker	17	4.2
	Other	8	
Income	Under 15,999	132	32.8
	16,000-25,999	57	14.1
	26,000-35,999	115	28.5
	36,000-45,999	43	10.7
	46,000-55,999	27	6.7
	56,000-65,999	18	4.5
	Over 66,000	11	2.7
Mobile LINE usage experience	Under 1 year	22	5.5
	About 2 years	205	50.8
	About 3 years	133	33.0
	Over 3 years	43	10.7

Table I. Sample demographics

Results

Measurement model

Confirmatory factor analysis was conducted using AMOS 21.0 for testing the measurement model. Hair *et al.* (1998) argued that most model-fit indices should reach accepted standards before being used for assessing model fitness. Table II shows that every model-fit index exceeded the recommended value from previous studies, exhibiting an adequate fit to the collected data.

Reliability and construct validity were considered to verify the adequacy of the measurement model. We assessed reliability by computing the composite reliability to evaluate the model's internal consistency. Table III shows that the composite reliability of our scales ranged from 0.79 to 0.92, higher than the recommended value of 0.7 (Fornell and Larcker, 1981). Regarding convergent validity (Table IV), three criteria must be met, as suggested by Bagozzi and Yi (1988): all indicator factor loadings on their respective constructs should be greater than 0.5; the composite reliability for each construct should exceed 0.7; and the average variance extracted (AVE) for each construct should exceed the threshold of 0.5. As shown in Table III, most items had indicator factor loadings greater than 0.5 on their respective constructs. In addition, the composite reliability of constructs ranged from 0.79 to 0.92, and the AVE for our scales ranged from 0.55 to 0.80. Therefore, the three criteria for convergent validity were met.

Discriminant validity was evaluated using a criterion suggested by Fornell and Larcker (1981), which states that the square root of the AVE for each construct should exceed the correlation between any pair of distinct constructs. Table IV presents the matrix of correlation coefficients for all constructs in the current study; the diagonal elements represent the square roots of the AVE for the constructs. The results revealed that the validity was adequate. In summary, our measurement model exhibited satisfactory reliability, convergent validity, and discriminant validity.

Hypothesis testing

The path coefficients of the research model were measured using AMOS 21.0. The model-fit indices for the structural model demonstrated a good model fit ($\chi^2/df = 2.80$, GFI = 0.87, AGFI = 0.83, NFI = 0.87, CFI = 0.91, RMSEA = 0.067). Figure 2 shows the standardized path coefficients, path significance levels, and variance explained (R^2) by each path.

All of our nine hypotheses were supported by the AMOS structural model, lending overall support to our proposed model of intention to use smartphones. The effect of the perceived needs-technology fit was a significant factor influencing both user intention to continue using LINE ($\beta = 0.58$, $t = 10.16$) and satisfaction ($\beta = 0.36$, $t = 6.74$),

Fit indices	Recommended value	Suggested by authors	Measurement model	Structural model
χ^2/df	⩽3	Hayduck (1987)	2.75	2.79
Goodness of fit index (GFI)	⩾0.8	Scott (1991)	0.87	0.87
Adjusted for degrees of freedom (AGFI)	⩾0.8	Scott (1991)	0.83	0.83
Normed fit index (NFI)	⩾0.9	Hair *et al.* (1998)	0.90	0.90
Comparative fit index (CFI)	⩾0.9	Bagozzi and Yi (1988)	0.92	0.91
Root mean square error of approximation (RMSEA)	⩽0.08	Bagozzi and Yi (1988)	0.066	0.067

Table II.
Fit indices for the measurement and structural models

Construct	Items	Mean	SD	Factor loadings	*t*-statistic	Composite reliability (CR)	Average variance extracted (AVE)
Utilitarian needs	UN1	4.04	0.55	0.78		0.81	0.58
	UN2	3.91	0.56	0.81	15.41		
	UN3	3.96	0.47	0.80	11.31		
Hedonic needs	HN1	4.02	0.54	0.80		0.83	0.63
	HN2	3.99	0.55	0.83	17.05		
	HN3	4.98	0.54	0.74	14.74		
Social needs	SN1	4.08	0.50	0.83		0.80	0.57
	SN2	4.05	0.49	0.79	16.35		
	SN3	4.00	0.43	0.64	12.78		
Mobile convenience	MC1	3.98	0.90	0.73		0.79	0.55
	MC2	3.77	0.85	0.76	12.86		
	MC3	3.96	0.79	0.74	12.05		
Service compatibility	SC1	3.92	0.96	0.75		0.83	0.62
	SC2	3.81	1.03	0.83	15.53		
	SC3	4.03	1.05	0.77	13.98		
User control	UC1	3.95	0.75	0.79			0.59
	UC2	4.01	0.79	0.81	15.34		
	UC3	3.92	0.83	0.70	12.99		
Perceive needs-technology fit	PNTF1	4.05	0.53	0.83		0.88	0.64
	PNTF2	4.03	0.55	0.86	21.08		
	PNTF3	3.96	0.47	0.77	17.58		
	PNTF4	3.98	0.55	0.73	15.97		
Satisfaction	SF1	3.81	0.78	0.85		0.92	0.80
	SF2	3.89	0.81	0.92	24.82		
	SF3	3.59	0.75	0.91	23.97		
Continuance intention to use	CIU1	4.14	0.83	0.81		0.85	0.66
	CIU2	3.86	0.94	0.83	17.19		
	CIU3	3.90	0.85	0.80	16.67		

Table III. Statistics of construct items

Construct	UN	HN	SN	MC	SC	UC	PNTF	SF	CIU
UN	*0.76*								
HN	0.47	*0.79*							
SN	0.56	0.58	*0.75*						
MC	0.42	0.39	0.40	*0.77*					
SC	0.58	0.50	0.47	0.43	*0.79*				
UC	0.44	0.45	0.43	0.40	0.39	*0.74*			
PNTF	0.62	0.69	0.65	0.50	0.62	0.51	*0.80*		
SF	0.27	0.24	0.20	0.23	0.23	0.31	0.32	*0.89*	
CIU	0.45	0.39	0.41	0.34	0.38	0.52	0.56	0.33	*0.81*

Notes: Diagonal elements (italics) are the square root of average variance extracted (AVE) between the constructs and their measures. Off-diagonal elements are correlations between constructs. For discriminant validity, diagonal elements should be greater than off-diagonal elements. All correlations are significant at $p < 0.01$

Table IV. Discriminant validity

supporting *H1* and *H2*. The results also indicated that users' satisfaction with LINE positively influenced their intention to continue using it ($\beta = 0.16$, $t = 3.19$), supporting *H3*. All motivational need constructs, namely, utilitarian ($\beta = 0.15$, $t = 2.27$), hedonic ($\beta = 0.37$, $t = 5.98$), and social ($\beta = 0.22$, $t = 3.21$) needs, exerted a significant influence

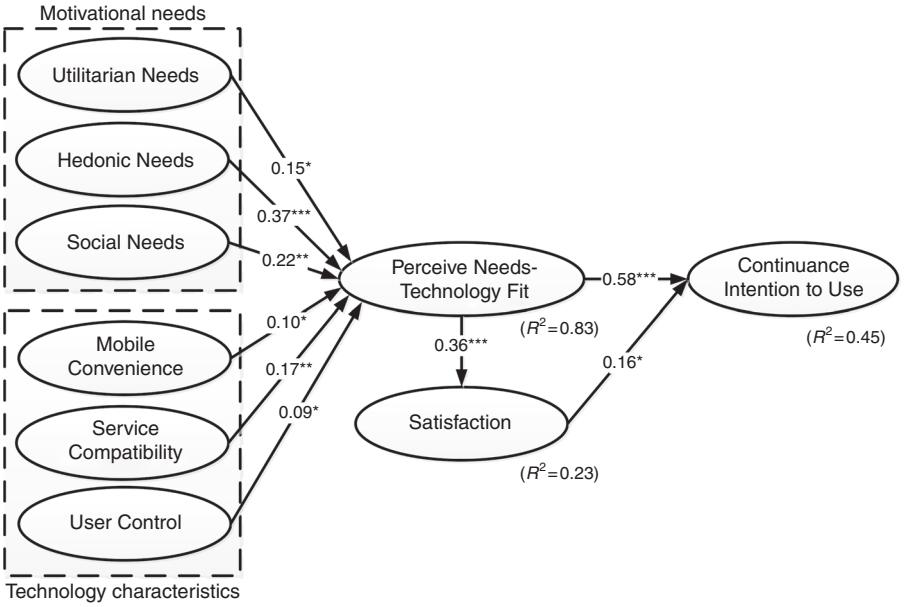

Figure 2.
Hypothesis test results

Notes: ***$p<0.001$; **$p<0.01$; *$p<0.05$

on the perceived needs-technology fit, supporting *H4a-H4c*. Moreover, the technological characteristic constructs including mobile convenience ($\beta=0.10$, $t=2.12$), service compatibility ($\beta=0.17$, $t=2.75$), and user control ($\beta=0.09$, $t=2.03$) exhibited a significant positive impact, supporting *H5a-H5c*. Finally, the research model could explain 45 percent of the variance in continuance intention, 23 percent of that in satisfaction, and 83 percent of that in the perceived needs-technology fit. All hypotheses and test results are summarized in Table V.

Discussion

Findings

We used a research model constructed with TTF theory and uses and gratification theory as a basis and adopted the perspectives of studies on user needs and

Hypothesis	Path	Path coefficient	*t*-value	Supported hypothesis
H1	PNTF→CIU	0.58	10.16***	Supported
H2	PNTF→SF	0.36	6.74***	Supported
H3	SF→CIU	0.16	3.20*	Supported
H4a	UN→PNTF	0.15	2.27*	Supported
H4b	HN→PNTF	0.37	5.97***	Supported
H4c	SN→PNTF	0.22	3.24**	Supported
H5a	MC→PNTF	0.11	2.09*	Supported
H5b	SC→PNTF	0.17	2.75**	Supported
H5c	UC→PNTF	0.09	2.02*	Supported

Table V.
Results of path coefficients

Notes: ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$

technological characteristics (Goodhue and Thompson, 1995; Kwai Fun IP and Wagner, 2008; Wei *et al.*, 2015) to propose an integrated model, called "perceived needs-technology fit," to identify the factors stimulating people's continued usage of mobile communication software. Our findings are described as follows.

Figure 2 illustrates the research results regarding users. First, consistent with the findings of previous studies (Kwai Fun IP and Wagner, 2008; Lin, 2012; Yen *et al.*, 2010), our structural model suggests that perceived needs-technology fit and satisfaction are two major factors stimulating users' intention to continue using mobile communication software services. In particular, the findings indicate that the perceived needs-technology fit is the most crucial factor affecting the behavior of mobile communication software users. This is because compared with traditional text messages, mobile communication software systems (e.g. LINE) enable users to engage in free communications, in addition to providing services like image posting, games, and social networking space (Liu, 2013). The provision of application services exhibiting diversified contents by such software systems enables users to perceive a fit between the functional characteristics of the technology and their own needs, thus stimulating their intention to continue using the services as well as their satisfaction. Our finding also confirms the view of Kwai Fun IP and Wagner (2008); hence, in providing services, mobile communication operators should consider the fit between user needs and technological characteristics to increase users' satisfaction and stimulate them to continue using the services.

Because mobile instant communication is a new form of social media service application (Hong *et al.*, 2013; Oghuma *et al.*, 2015, 2016), for users, LINE is not only a task-oriented and hedonic-oriented communications application but also a social-oriented one (Liu, 2013). We discovered that users' utilitarian, hedonic, and social needs all have direct and positive effects on their perceived needs-technology fit, with hedonic needs exerting the most significant effect on this perceived fit. This finding is consistent with those of several studies (Lin and Bhattacherjee, 2008; Lin and Lu, 2015; Sledgianowski and Kulviwat, 2009), indicating that in the context of a pleasure-oriented information system, pleasure plays a highly crucial role. Liu (2013) stated that although LINE increases users' amusement when communicating with their friends by enabling them to post-images that express their moods and thoughts, services such as phone games and pleasure APPs can enhance users' delightful feelings with their friends, thus facilitating them to perceive the needs-technology fit. This clearly shows that in a pleasure-oriented information system, creating a pleasant interaction environment can be more effective than simply focusing on utilitarian benefits.

Next, we observed the influence of social needs on users' perceived needs-technology fit. As mentioned, LINE can meet users' hedonic needs by providing services like phone games and image posting, most of which facilitate users' interactions with their friends. For instance, all LINE games combine a friend mechanism, enabling players to compete with other users and ranking them in terms of their game scores; this mechanism and social services such as image shop and gift mechanism can increase the opportunities for users to interact with their friends in addition to reinforcing real interpersonal relationships, satisfying users' social needs.

Finally, we determined that utilitarian needs exerted a positive effect on users' perceived needs-technology fit. With mobile communication software, users are not restricted to the use of PCs for logging into communication software systems. Instead, users can use mobile communication software through their smartphones anytime, anywhere, and this enhances the efficiency with which they share information and connect

with others in addition to facilitating them in acquiring information and exchanges instantly (Liu, 2013), thus further enabling them to achieve their utilitarian needs.

Technological characteristics such as mobile convenience, service compatibility, and user control directly and positively influence users' perceived needs-technology fit. First, our findings, consistent with those of other studies (Kim and Hwang, 2010; Lin and Lu, 2015; Seo *et al.*, 2013), reveal that users argued that mobile convenience enabled them to use a service at any time and place; therefore, their perception of the needs-technology fit was enhanced. Regarding service compatibility, when using mobile communication software through mobile devices, users can use services (e.g. sending messages, talking, posting images, and editing social networking space) in the same manner as they can when using communication software on PCs, enhancing their perceived needs-technology fit. Finally, regarding user control, our findings indicate that when the users perceive using communication software through mobile devices to be easy overall, their perception of the needs-technology fit is enhanced. Therefore, mobile communication service providers should consider a concise operating interface design to enable users to understand their systems easily and use the corresponding services effortlessly, reinforcing users' positive perception of MIM control.

Theoretical contributions

The results of this study have several vital academic implications. First, as verified by previous studies (Kwai Fun IP and Wagner, 2008; Lu and Yang, 2014), TTF directly affects users' acceptance for and use of social media. Kwai Fun IP and Wagner (2008) argued that regarding users' social media usage behavior, it is necessary to explore the fit between their needs and the technological characteristics from the perspective of these two elements. From such a perspective, we propose a needs-technology fit research model to explore the factors influencing the usage behaviors of mobile communication software users and reveal the possible effects of such factors on the users' intention to continue using such software. Second, users' perceived needs-technology fit and satisfaction predicted their intention to continue using mobile communication software, with the perceived needs-technology fit exerting the most significant effect on their use of such software. We incorporated user satisfaction to comprehensively predict users' intention to continue using mobile communication software. Third, as with the antecedents of perceived needs-technology fit, the motivational needs comprised external motives (utilitarian needs) and internal motives (hedonic needs and social needs), and the technological characteristics comprised mobile convenience, service compatibility, and user controllability. We determined that in the context of social-oriented information technology, all of these factors play significant roles in affecting the perception of the needs-technology fit regarding mobile communication software. Finally, the proposed research model is demonstrated to be effective in explaining and accurately predicting users' intention to continue using mobile communication software, providing new directions for subsequent studies.

Practical implications

Several implications for practitioners can be drawn from this study. First, users' intention to continue using mobile communication software is affected by their perceived needs-technology fit and satisfaction. This indicates that mobile communication service providers should be aware that MIM services must meet users' needs and that a fit must exist between technological characteristics and user

needs (Kwai Fun IP and Wagner, 2008); addressing these requirements can enable service providers to increase user satisfaction and, in turn, attract users to continue using a service. Second, users' hedonic needs exert a more significant effect on their perceived needs-technology fit than do their social and utilitarian needs. Liu (2013) stated that LINE's services (such as images and games) are the most popular among its users, suggesting that focusing on a pleasurable, interactive environment, which MIM providers must actively establish, can be more effective than focusing on utilitarian benefits. Hence, service providers should continue developing APPs that provide pleasurable experiences. Third, MIM technological characteristics, namely, mobile convenience, service compatibility, and user control, effectively increase the degree of users' perceived needs-technology fit. Service compatibility has the most considerable effect on the perceived needs-technology fit. This result provides vital information to MIM service providers, indicating that users' perception of utilitarian, hedonic, and social-oriented MIM services mainly entails whether such services can be used on mobile devices exactly as they can on PCs. Therefore, creating an environment with high service compatibility can be more effective than focusing on mobile convenience and user control.

Limitations and future research

Despite the valuable findings and implications, this study has some limitations. First, the implications are based on a single study with samples derived from Taiwan. Therefore, caution should be exercised when generalizing the findings to other MIM situations. Researchers in future studies should conduct examinations in cross-cultural and cross-marketplace contexts to investigate and compare the differences in the antecedents to continuance intention. Second, we employed a quantitative statistical research model and collected data by means of an online questionnaire; it is thus difficult for represented research sampling to avoid self-selection. We suggest that future studies use a qualitative assisted quantitative viewpoint to support their findings. Third, this study was cross-sectional, indicating that samples were collected over a specific period, rendering them applicable to only that period. Therefore, a longitudinal analysis may remedy this problem by thoroughly tracking developments and conditions.

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Further reading

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Appendix. The questionnaire

Utilitarian needs (UN)

(UN1) I think mobile LINE allows me to manage my work or coursework any time anywhere.
(UN2) I think mobile LINE allows me to gather information for problem solving in the workplace or institution.
(UN3) I think mobile LINE allows me to acquire/deal with my work or coursework information in real time.

Hedonic needs (HN)

(HN1) Compared to other things I could have done, the time spent in mobile LINE was truly enjoyable.
(HN2) The use of mobile LINE gave me pleasure.
(HN3) While using mobile LINE, I enjoyed being immersed in the environment.

Social needs (SN)

(SN1) I think mobile LINE allows me to develop new relationships for my social situation.
(SN2) I think mobile LINE allows me to maintain existing relationships for my social situation.
(SN3) I think mobile LINE allows me to communicate with others for my social situation.

Mobile convenience (MC)

(MC1) Using mobile LINE is an efficient way to manage my time.
(MC2) Using mobile LINE would be convenient for me.
(MC3) Using mobile LINE would allow me to use LINE service instantly.

Service compatibility (SC)

(SC1) Using mobile LINE fits my service needs.
(SC2) Mobile LINE is compatible with the LINE service I normally employ on personal computer (PC).
(SC3) Mobile LINE fits my service preferences.

User control (UC)

(UC1) I don't think using mobile LINE is complicated.
(UC2) Learning to use the SNS is easy for me.
(UC3) Using mobile LINE services for my work or coursework allows me to make a lot of decisions on my own.

Perceived needs-technology fit (PNTE)

(PNTF1) Mobile LINE's functions are appropriate for my needs.
(PNTF2) Mobile LINE's functions are suitable for helping me complete my needs.

(PNTF3) Real-time mobile LINE's functions are appropriate.
(PNTF4) In general, mobile LINE's functions are enough to help me complete my needs.

Satisfaction (SF)
(SF1) I am satisfied to use mobile LINE as support tools.
(SF2) I like to use mobile LINE.
(SF3) Using mobile LINE makes me feel very satisfied.

Continued intention to use (CIU)
(CIU1) I intend to use continuously mobile LINE.
(CIU2) I predict that I would use continuously mobile LINE in the future.
(CIU3) I will recommend my friends to use mobile LINE.

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