Can an Enterprise System Persuade? The Role of Perceived Effectiveness and Social Influence

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Abstract. This study provides an interpretation to empirically explain and predict use continuance intention of students towards an enterprise resource planning (ERP) system. A research model based on the information system continuance, the social identity theory, and the unified theory of acceptance and use of technology was adopted and analyzed using partial least squares structural equation modeling. The analysis uncovered important roles that perceived effectiveness and social influence play in explaining the intention of students to continue using the ERP. Further, the model demonstrated how primary task support contributes to perceived effort, which helps in explaining perceived effectiveness of the system. Computer-human dialogue support significantly contributes to perceived credibility, primary task support and perceived social influence. Social identification of the students significantly predicts perceived social influence. Research related to continuous usage of an ERP system is viable, as it enables designers and developers building more persuasive enterprise and socially influencing systems.

Keywords: Persuasive technology · Enterprise resource planning system
Use continuance · Perceived effectiveness · Social influence

1 Introduction

The design of a hardware and its interface can influence how an individual interacts with it and consequently alter his or her behavior. In addition, persuasive functionalities may also be incorporated into a system's design to change attitude or behavior. Although several studies have been conducted to demonstrate that persuasive technologies are effective in changing human behavior, not much have been done on how an introduction of persuasive features in enterprise systems can promote their use continuance. The acceptance and continuous use of enterprise resource planning (ERP) systems is paramount, as it determines their success or failure.

However, existing theories for measuring acceptance and use continuance of technologies and information systems mostly examine factors that stimulate individuals

to initially adopt them rather than factors that would influence their continuous use [1, 13]. This research therefore seeks to investigate the relationship between persuasive features in an enterprise system and how they impact its use continuance.

2 Background

An ERP system is a software for business management, it include modules for supporting functional areas such as planning, manufacturing, sales, marketing, distribution, financial accounting, human resource management, project management, inventory management, service and maintenance, transportation and electronic business [2]. Many organizations nowadays resort to the implementation of ERP system in order to match up with the competitive environment [21]. The benefit organizations draw from ERP installations may be realized at different levels which include operational, managerial, strategic, infrastructural and organizational [19].

Theories relating to the continuous use of ERP systems include expectation-confirmation theory (ECT) and information system continuance (ISC) model [1]. ECT and ISC were developed for post adaption behaviors. ISC model posits that users' intentions to continue usage of an information system is influenced by three antecedents which are satisfaction, confirmation and perceived usefulness. ISC differs from ECT in several ways including: 1. ISC focuses on post-adoption expectations because users' expectation toward using IS after gaining experience must be different from expectations before usage; 2. post-adoption expectations is represented by perceived usefulness; and 3. perceived performance is not included because it is assumed to be captured in the confirmation construct.

3 Research Model

This study adapted a research model (Fig. 1) that is based on information system continuance, social identity theory, unified theory of acceptance and use of technology, and persuasive technology [14]. According to Robey et al. [3], tried and tested instruments are effective in measurement. The theoretical underpinning for this is that, such instruments enable the researcher to gather enough knowledge and maintain comparability between researches. The scales for measuring the constructs of the research model were also adopted [14]. Questionnaires were designed, and checks indicated that they demonstrated good content validity, i.e. face and expert validity before they were administered. The perceived effort (EFFO) and perceived effectiveness (EFFE) were modified from the unified theory of acceptance and use of technology [26], social identification (SOID) was adopted from the social identity theory, while use continuance intention (CONT) was adopted from expectation-confirmation theory [1].

3.1 Computer-Human Dialogue

Computer-human dialogue support (DIAL) keeps users active and motivated in using an information system [14]. System-to-user prompts, triggers, reminders and positive

feedback play an important role in computer-human dialogue support. Information technology artefacts are social actors, according to [16, 18]. Consequently, users envisage their interaction with information technology artefacts to be interpersonal in nature. Furthermore, users tend to see their interaction with information technology artefacts as in social situations [12, 18]. Thus, it is hypothesized that:

H1a: Computer-human dialogue support positively impacts perceived social influence.

Computer-human dialogue support keeps users active and motivate them to perform their primary task. This indicates that computer-human dialogue support encourage students when engaged in activities such as course registration, verification of personal data, checking exam results, etc. Hence, it has a direct link to perceived effectiveness and primary task support. Thus, it is hypothesized that:

H1b: Computer-human dialogue support positively impacts perceived effectiveness.
H1c: Computer-human dialogue support has a positive effect on primary task support.

According to [11], computer-human dialogue support has the potential to influence users' confidence in a system. This means that it will possibly impacts students' confidence in the use of the ERP. Thus, it is hypothesized that:

H1d: Computer-human dialogue support has a positive effect on perceived credibility.

3.2 Primary Task Support

Primary task support (PRIM) is the means given by the system to assist the user to carry out his or her goal [14]. It is related to cognitive fit, task-technology fit, and person-artefact-task [5]. It aids reflection on a user's behavior, personal goal setting, and keeping of track progress towards the goals [15]. It impacts perceived persuasiveness positively [14], whilst perceived persuasiveness and perceived effectiveness are related [19].

This indicates that the ERP provides functionalities for the students to engage in activities such as course registration, checking semester results, uploading and verifying personal data, just to mention a few. Thus, it is hypothesized that:

H2a: Primary task support has a positive effect on perceived effectiveness.

Since primary task support reduces the cognitive burden and disorientation towards the use of the ERP, it is also hypothesized that:

H2b: Primary task support has a positive effect on perceived effort.

3.3 Perceived Credibility

Trust and credibility (CRED) are important and related construct when dealing with the continuous use of an information system. For a system to be credible, it has to build trust in users [4]. The objective of this research does not involve a detailed understanding of trust; therefore, such issues are integrated in perceived credibility. According to Shin [20], perceived trust positively influences user behavior in social commerce environment. This means that the perceived credibility that the Institute's

students envisage in the ERP, positively impacts their intention to continuously use the system. Thus, it is hypothesized that:

H3: Perceived credibility has a positive effect on use continuance intention.

3.4   Perceived Effort

In existing technology adoption theories, perceived ease of use, a construct of technology acceptance model [6] and effort expectancy, a construct of unified theory of acceptance and use of technology [27] have proven to be the two basic constructs that explains one's intention to use a system continuously. Perceived effort relates to one of the propositions of expectancy theory of motivation. This implies that, one's effort will result in the realization of desired performance goals, i.e. perceived effectiveness in the case of this research.

It can therefore be concluded that the degree of ease associated with the use of the ERP (perceived effort) motivates the institute's students that the ERP will help them improve their online interactions with the university. Thus, it is hypothesized that:

H4a: Perceived effort has a positive effect on perceived effectiveness.

Effort expectancy positively influences behavioral intention [27]. This logically follows that perceived effort has a direct impact on use continuance intention. Thus, it is hypothesized that:

H4b: Perceived effort has a positive effect on use continuance intention.

3.5   Perceived Social Influence

Most individuals taking part in online social activities are merely readers of discussion forums, searchers of blog posts, or observers of photos or other media [17]. Social influence may be connected with aspects of the social network i.e. groups and families, specific behaviors e.g. emotional or informational support or our perceived availability of support resources [25]. Social influence may also be described as an exchange of resources between two individuals perceived by the provider or the recipient to be intended to enhance the wellbeing of the recipient. It is in the form of encouragement, motivation, information and shared experience [9]. This promotes perceived effectiveness.

Hence, the decision of the institute's students to use the ERP will be influenced by their fellow students and will consequently deepen their desire that the ERP will help improve their online interaction with the university. Thus, it is hypothesized that:

H5a: Perceived social influence has a positive effect on perceived effectiveness.

Social influence is a direct determinant of use intention [27]. Moreover, perceived social influence directly affects use behavior [20]. Thus, it is also hypothesized that:

H5b: Perceived social influence has a positive effect on use continuance intention.

3.6 Social Identification

According to Hogg [10], group cohesion is the sense of members' attraction to the group. It is important to note that group cohesion and social identification are similar constructs. Cohesion strengthens when members in a group perceived that shared goals and objectives can be reached through group action [8]. Group cohesion has a significant effect on task participation and social presence.

This indicates that students' sense of attraction to the use of the ERP is impacted by their colleagues using it. Thus, it is hypothesized that:

H6: Social identification has a positive effect on perceived social influence.

3.7 Perceived Effectiveness

Performance expectancy prognosticates intention to use [27]. The institute's students will continue to use ERP so far as the ERP enables them to perform their online interaction with the university. The construct perceived effectiveness measures students' perceptions regarding whether the ERP is successful in aiding them to register courses, check exam results, verify and upload relevant data. Hence, performance expectancy is equated to perceived effectiveness. It logically follows that, if the students do not perceive the ERP to be effective, they are likely to stop using it. Thus, it is hypothesized that:

H7: Perceived effectiveness has a positive effect on use continuance intention.

4 Methodology

Based on deductive reasoning from earlier research [14], the hypotheses were tested to confirm or refute the proposed relationships. The numerical data collected from participants were used to represent the theoretical constructs and concepts and the interpretation of these values were considered as scientific evidence on use continuance intention on the studied ERP.

The data collection instrument used in this study was questionnaire. Data was collected using an online survey software (google forms). The same tool was used in designing the questionnaire. The questionnaire was administered through email. The process of collection lasted for four weeks. Participation was purely voluntary, and no student was coerced into participating in the research. Undergraduate and graduate students of various faculties were involved. Prior to participation, each student read and completed an informed consent form. Participants were assured of privacy and anonymity. Out of the three hundred (300) questionnaires administered, one hundred and four (104) responses were received and used. The questionnaire consisted of demographic questions and five-point Likert scale items (ranging from strongly agree to strongly disagree).

5   Data Analysis

SmartPLS was used for data analysis, as it contains tools for PLS-SEM that are suitable for predicting outcomes of research models. It employs component-based path modeling, which is robust when it comes to deviation from a multivariate distribution [7].

5.1   Outer Model and Measurement Model

The outer model describes the relationship among the latent variables and their indicators whereas the measurement model is the mathematical equations that express the relationship among the latent variables and their indicators. Table 1 presents the reliability statistical measures for the study.

Table 1. Latent variable coefficients

	Cronbach's alpha	rho_A	Composite reliability	Average variance extracted (AVE)
CONT	0.812	1.086	0.906	0.829
CRED	0.888	0.893	0.922	0.748
DIAL	0.794	0.810	0.865	0.617
EFFE	0.924	0.924	0.952	0.867
EFFO	0.928	0.939	0.949	0.822
PRIM	0.698	0.698	0.833	0.624
SOCS	0.857	0.909	0.913	0.778
SOID	0.785	0.884	0.899	0.817

In Table 2, the calculated value in bold on the diagonal are the square root of AVE for each latent variable. Latent variable CRED has an AVE of 0.748 from Table 1. Hence, its square root is 0.864. This number is larger than the correlation values in the column of CRED i.e. (0.472, 0.702, 0.596, 0.596, 0.417, 0.459) and larger than those in the row of CRED i.e. (−0.396). Similar observation can be inferred from all the other latent variables. This indicates that discriminant validity is well established among the variables.

Table 2. Fornell-Larcker criterion analysis for checking discriminant validity.

	CONT	CRED	DIAL	EFFE	EFFO	PRIM	SOCS	SOID
CONT	**0.910**							
CRED	−0.396	**0.864**						
DIAL	−0.310	0.472	**0.785**					
EFFE	−0.452	0.704	0.566	**0.931**				
EFFO	−0.404	0.596	0.549	0.613	**0.906**			
PRIM	−0.405	0.596	0.579	0.585	0.593	**0.789**		
SOCS	−0.151	0.417	0.594	0.567	0.374	0.457	**0.882**	
SOID	−0.073	0.459	0.566	0.513	0.470	0.450	0.536	**0.903**

5.2 Inner Model and Structural Model

The inner structure describes the relationship among the latent variables that make up the model. The structural model is the mathematical equation that expresses the relationship among latent variables. With the help of bootstrapping procedure, SmartPLS generated a T-Statistics for significance testing of both the inner and outer model. The bootstrapping process resulted in the information provided in Table 3 and Fig. 1.

Table 3. Statistical path coefficients and significance

	Original sample	Sample mean	Standard deviation	T-statistics	P-value
SOID → SOCS	0.294	0.303	0.117	**2.514**	**0.012**
DIAL → EFFE	0.091	0.096	0.114	0.796	0.426
DIAL → CRED	0.472	0.482	0.074	**6.333**	**0.000**
DIAL → SOCS	0.427	0.427	0.103	**4.170**	**0.000**
DIAL → PRIM	0.579	0.585	0.069	**8.415**	**0.000**
PRIM → EFFE	0.198	0.202	0.114	1.746	0.081
PRIM → EFFO	0.593	0.601	0.069	**8.613**	**0.000**
EFFO → EFFE	0.335	0.325	0.124	**2.693**	**0.007**
SOCS → EFFE	0.297	0.300	0.110	**2.696**	**0.007**
CRED → CONT	−0.101	−0.108	0.141	0.715	0.475
SOCS → CONT	0.165	0.178	0.118	1.397	0.163
EFFO → CONT	−0.184	−0.185	0.120	1.539	0.124
EFFE → CONT	−0.362	−0.364	0.147	**2.467**	**0.014**

The values in the 'T-Statistics' column determines if the path coefficient of the inner model is significant or not. Using a two-tailed t-test with a significance level of 5%, the path coefficient will be significant if the 'T-Statistics' is larger than 1.96 (marked as bold in Table 3). Two different values are indicated on each arrow line in Fig. 1. The upper ones represent structural path significant strength among the constructs or latent variables in the model (T-statistics). The higher values represent more significance and vice versa. The values in the variables represent the coefficient of determination, R^2. These values explain the percentage of variance. The lower ones represent inner model path coefficient size. Standardized path coefficients value lower than 0.1 indicates that path is statistically not significant. Based on the results of the PLS-SEM analysis (Fig. 1), the following conclusions were drawn on use continuance intention of the ERP that was studied. The coefficient of determination, R^2, for continuance intention is 0.253 (see Fig. 1). This indicates that the exogenous or independent variables, i.e. CRED, EFFO, SOCS and EFFE moderately explain 25.3% of the variance in CONT (continuance intention). An endogenous variable is the same as dependent variable. SOCS, DIAL, PRIM and EFFO together explain 54.1% of the variance of EFFE, (i.e. Perceived Effectiveness). DIAL and SOID together explain 41.2% of the variance of SOCS (i.e. Perceived Social Influence). DIAL alone explains 33.5% of the variance of PRIM (i.e. Primary Task Support). Whilst DIAL explains 22.2% of the variance of CRED (i.e. Perceived Credibility). Primary Task Support (PRIM) accounts for 35.1% of the variance of Perceived Effort (EFFO).
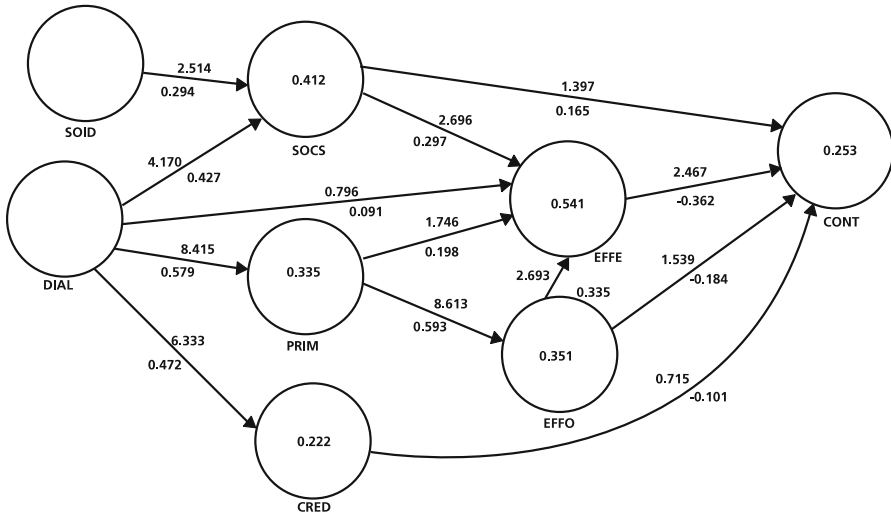
Fig. 1. The research model with the results of the PLS-SEM analysis

The inner model suggests that perceived social influence (SOCS) has the strongest impact on continuance intention with a value of 0.165. On the other hand, perceived effectiveness, perceived effort and perceived credibility have no significant impact on continuance intention because they are negative values i.e. −0.362, −0.184 and −0.101 respectively. The relationship between perceived social influence and continuance intention is statistically significant. However, the one between perceived effectiveness and continuance intention, perceived effort and continuance intention, perceived credibility and continuance intention are all statistically not significant. This is because their standardized path coefficients are lower than 0.1. Perceived social influence is moderately strong predictor of continuance intention, but perceived effectiveness, perceived effort and perceived credibility do not predict continuance intention directly.

6   Discussion

In this study, a research model proposed [14] was adopted to explain and predict use continuance intention of an ERP. The outcomes of the analysis confirmed most of the hypotheses. All the constructs of the research model have a significant impact. With human-computer dialogue support, the system must provide relevant, motivating feedback to the students via words, images, sounds and other forms of media. Its role in the adopted model is significant in that, it affects perceived social influence. Perceived social influence strongly influences use continuance. Through social identification, students easily relate to the experiences of their colleagues on the ERP platform. It is evident in the structural model that social identification influence use continuance indirectly through other constructs.

A strong positive connection from social identification on perceived social influence was confirmed. This agrees with the idea that information technology artefacts can be designed to perform as social actors [22]. Tuunanen et al. [24] found that students rarely use any information system in isolation but would like to connect with others. Computer-human dialogue support plays a key role when it comes to students' intention towards the ERP. Students need to be prompted, suggested to and reminded of necessary tasks that they need to perform. Looking at the results carefully, social identification and computer-human dialogue support explains considerably 41.2% of the variance of perceived social influence. Perceived credibility involves how trustworthy, reliably, believable and credible the ERP should be. As seen in the model, (Fig. 1) perceived credibility has significant relationship to continuance intention. However, computer-human dialogue accounts for 22.2% of the variance of perceived credibility.

This study contributes to the research of continuous use of ERP systems, which can be promoted by incorporating suitable sets of persuasive mechanisms into it design. Perceived social influence was found to be the stronger construct that impacts use continuance. This is indicative of the fact that persuasive features promote use continuance intention, as it has similarly been confirmed in other recent research work related to behavioral intentions [10, 14, 20] and user engagement [23].

To further gain insights into the underlying persuasive mechanisms, multi group analysis was performed on the demographic data available. Gender, age range and level of study were the focus, which helped to uncover several interesting observations. For the male participants, perceived effort had a strong impact on use continuance. For the female participants, perceived social influence strongly impacts use continuance. Whereas for participants under age of 26, perceived social influence strongly impacted use continuance. Amongst graduate students, perceived effort strongly impacted use continuance, while within undergraduate students, perceived social influence was the main contributor for use continuance.

7   Conclusions

After the empirically examination of users' continuance intention towards a selected ERP system, it has been established that the introduction of persuasive features into enterprise systems can promote use continuous. As such, ERPs must be designed to possess features that engage and retain students in order to take full advantage of its use. Persuasive features are keys factors that motivate student continuance use of such systems. User resistant to use in the post implementation process has been identified as one of the root causes of ERP implementation failure. For the ERP to continue to serve its purpose, users must be motivated by embedded persuasive mechanism.

Although this study has provided empirical evidence that supports the fact that the introduction of persuasive features into enterprise systems can help promote continuous use, there is the need for further studies to be conducted to ascertain whether this notion may hold for other systems. This is because mostly ERPs are used in business and industries where the users (employees) often do not have the choice to avoid using it. However, within the academic industry, students are a special type of customers who

also ends up being products of the same institution. Hence the type of psychological contract that exist between the students and their institution may differ from the one between a typical employer and employee. It is therefore recommended that future research should focus on non-academic industry to verify whether the findings of this study holds among all industries.

References

1. Bhattacherjee, A.: Understanding information systems continuance: an expectation-confirmation model. MIS Q. **25**, 351 (2001). https://doi.org/10.2307/3250921
2. Botta-Genoulaz, V., Millet, P.A.: An investigation into the use of ERP systems in the service sector. Int. J. Prod. Econ. **99**, 202–221 (2006). https://doi.org/10.1016/J.IJPE.2004.12.015
3. Robey, D., Ross, J.W., Boudreau, M.C.: Learning to implement enterprise systems: an exploratory study of the dialectics of change. J. Manag. Inf. Syst. **19**, 17–46 (2002)
4. Everard, A., Galletta, D.F.: How presentation flaws affect perceived site quality, trust, and intention to purchase from an online store. J. Manag. Inf. Syst. **22**, 55–95 (2005)
5. Finneran, C.M., Zhang, P.: A person–artefact–task (PAT) model of flow antecedents in computer-mediated environments. Int. J. Hum. Comput. Stud. **59**, 475–496 (2003). https://doi.org/10.1016/S1071-5819(03)00112-5
6. Davis, F.D.: Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Q. **13**, 319–340 (1989)
7. Gefen, D., Rigdon, E.E., Straub, D.: Editor's comments: an update and extension to SEM guidelines for administrative and social science research. MIS Q. **35**, 3–14 (2011)
8. Hsu, C.-L., Lu, H.-P.: Consumer behavior in online game communities: a motivational factor perspective. Comput. Hum. Behav. **23**, 1642–1659 (2007). https://doi.org/10.1016/j.chb.2005.09.001
9. Hwang, K.O., Ottenbacher, A.J., Green, A.P., Cannon-Diehl, M.R., Richardson, O., Bernstam, E.V., Thomas, E.J.: Social support in an Internet weight loss community. Int. J. Med. Inform. **79**, 5–13 (2010). https://doi.org/10.1016/J.IJMEDINF.2009.10.003
10. Jin, X.-L., Lee, M.K.O.: Cheung, C.M.K: Predicting continuance in online communities: model development and empirical test. Behav. Inf. Technol. **29**, 383–394 (2010)
11. Kahn, B.E., Isen, A.M.: The influence of positive affect on variety seeking among safe, enjoyable products. J. Consum. Res. **20**, 257–270 (1993)
12. Kang, Y.S., Hong, S., Lee, H.: Exploring continued online service usage behavior: the roles of self-image congruity and regret. Comput. Hum. Behav. **25**, 111–122 (2009). https://doi.org/10.1016/J.CHB.2008.07.009
13. Karahanna, E., Straub, D.W., Chervany, N.L.: Information technology adoption across time: a cross-sectional comparison of pre-adoption and post-adoption beliefs. MIS Q. **23**, 183 (1999). https://doi.org/10.2307/249751
14. Tuomas, L., Oinas-Kukkonen, H.: Explaining and predicting perceived effectiveness and use continuance intention of a behaviour change support system for weight loss. Behav. Inf. Technol. **34**, 176–189 (2015)
15. Locke, E.A., Latham, G.P.: Building a practically useful theory of goal setting and task motivation: a 35-year odyssey. Am. Psychol. **57**, 705–717 (2002). https://doi.org/10.1037//0003-066x.57.9.705
16. Nass, C., Moon, Y.: Machines and mindlessness: social responses to computers. J. Soc. Issues **56**, 81–103 (2000)

17. Preece, J., Shneiderman, B.: The reader-to-leader framework: motivating technology-mediated social participation. AIS Trans. Hum.-Comput. Interact. THCI **1**, 13–32 (2009)
18. Al-Natour, S., Benbasat, I.: The adoption and use of IT artifacts: a new interaction-centric model for the study of user artifact relationships. J. Assoc. Inf. Syst. **10**, 661–685 (2009)
19. Shang, S., Seddon, P.B.: A comprehensive framework for classifying the benefits of ERP systems. In: Association for Information Systems AIS Electronic Library (AISeL), vol. 1, pp. 1–11 (2000)
20. Shin, D.-H.: User experience in social commerce: in friends we trust. Behav. Inf. Technol. **32**, 52–67 (2013). https://doi.org/10.1080/0144929X.2012.692167
21. Spathis, C., Constantinides, S.: The usefulness of ERP systems for effective management. Ind. Manag. Data Syst. **103**, 677–685 (2003). https://doi.org/10.1108/02635570310506098
22. Stibe, A.: Towards a framework for socially influencing systems: meta-analysis of four PLS-SEM based studies. In: MacTavish, T., Basapur, S. (eds.) PERSUASIVE 2015. LNCS, vol. 9072, pp. 172–183. Springer, Cham (2015). https://doi.org/10.1007/978-3-319-20306-5_16
23. Stibe, A., Larson, K.: Persuasive cities for sustainable wellbeing: quantified communities. In: Younas, M., Awan, I., Kryvinska, N., Strauss, C., Thanh, D. (eds.) MobiWIS 2016. LNCS, vol. 9847, pp. 271–282. Springer, Cham (2016). https://doi.org/10.1007/978-3-319-44215-0_22
24. Tuunanen, T., Myers, M.D., Harold, C., Cassab, H.: A conceptual framework for consumer information systems development. Pacific Asia J. Assoc. Inf. Syst. **2**, 47–66 (2010)
25. Uchino, B.N.: Social support and health: a review of physiological processes potentially underlying links to disease outcomes. J. Behav. Med. **29**, 377–386 (2006). https://doi.org/10.1007/s10865-006-9056-5
26. Venkatesh, V., Thong, J.Y.L., Xu, X.: Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. MIS Q. **36**, 157–178 (2012)
27. Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D.: User acceptance of information technology: toward a unified view. MIS Q. **27**, 425–478 (2003)