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Continuance Intention to use High Maintenance Information Systems: The Role of Perceived Maintenance Effort

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CONTINUANCE INTENTION TO USE HIGH MAINTENANCE INFORMATION SYSTEMS: THE ROLE OF PERCEIVED MAINTENANCE EFFORT

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Abstract

Information Systems (IS) continued use theories have typically excluded a role for effort expectancy and similar constructs arguing that they do not impact the intentions of experienced users. This may not hold true for an emerging class of information systems that we refer to as High Maintenance Information Systems (HMIS). HMIS are a class of information systems that require users to expend an ongoing maintenance effort in order to keep the system up-to-date so they can continue to reap future benefits out of using the system. This ongoing maintenance effort is unlikely to significantly diminish as users gain further experience. The proposed study seeks to develop a theoretical model that explains the factors influencing individuals' continued use of such systems taking into account the potential role of perceived maintenance effort. The proposed model will be validated using a survey design involving experienced Facebook users. Collected data will be analyzed using structural equation modeling and qualitative data analysis techniques.

Keywords: High Maintenance Information Systems, IS Continuance, Expectation-Confirmation Model, Structural Equation Modeling

1 INTRODUCTION

Although initial acceptance and use is a necessary step toward Information Systems (IS) success, long-term viability of an IS depends highly on its continued use rather than its initial use (Bhattacharjee 2001). In addition, persistent behavior is believed to be more complex than initial performance (Ronis et al. 1989). Consequently, it is important to investigate IS users' continued usage behavior over time in order to gain a better understanding of this phenomenon as users gain experience in using an IS (Kim and Malhorta 2005). Of particular interest of the proposed study is how user perceptions of effort associated with using an IS evolve over time.

Numerous studies have identified that an individual's expectations regarding the effort required for using an information technology determines their initial acceptance of that technology. Example constructs capturing initial user expectations regarding the effort required to operate an information system include "perceived ease of use" (Davis 1986; Davis et al. 1989; Moore and Benbasat 1991), "complexity" (Thompson et al. 1991), and "effort expectancy" (Venkatesh et al. 2003). However, prior research suggests that as users gain experience in using an information system, the effect of "ease of use" or similar constructs on usage will diminish (Venkatesh et al. 2003). Similarly, this construct is not believed to have an impact on IS continuance (Bhattacharjee 2001). The reason for this is that current measures of "ease of use" pertain to the effort required to learn to operate an IS. Therefore, the effect of such effort on IS use will diminish as users gain experience in using the system and as such will perceive no significant effort in operating the system.

While the above argument may be true for many types of information systems, it may not hold true for some emerging types of IS which require significant maintenance effort past the initial adoption stage. We refer to this emerging class of information systems as High Maintenance Information Systems (HMIS). In order to clarify the boundaries of this class of information systems, we define HMIS as information systems that require an ongoing maintenance effort in addition to the effort required to initially learn how to operate the system. Such an ongoing maintenance effort is critical for users to continue to derive utility out of such systems. As such, at least some of the benefits associated with using HMIS are not realized in the immediate future but are rather realized in the medium to long term future. The extent of such future benefits is dependant, in part, on the level of effort invested by the user in maintaining the HMIS on an ongoing basis.

Examples of HMIS may exist in a range of contexts. For example, in healthcare we categorize Personal Health Records (PHR) systems as a HMIS. A PHR system is an information system that is initiated and maintained by an individual and contains life-long records of the individuals health and well-being information (Tang et al. 2006). Ideally, a PHR system should provide a thorough and accurate summary of health history of the individual. The individual owning the PHR system or anyone with proper authority (e.g. physician) is then able to generate reports from the system to support health-related decision making based on information stored in the system. The presence of inaccurate information in the PHR or the absence of even a small critical piece of information could result in the wrong healthcare decisions being taken to the detriment of the patient (Tang et al. 2006). Therefore, a PHR owner must expend an ongoing and significant maintenance effort to keep the system up-to-date. An example of HMIS in a different context is a social networking site such as Facebook that requires the user to maintain his/her profile continuously to keep up with peers. In this case, the more the user interacts with peers through the site, the more his/her gain of the potential benefits of Facebook usage will be (Ellison et al. 2007). Facebook users need to put significant effort on an ongoing basis in order to keep their profiles up-to-date, maintain their social relations, and communicate with their peers. Without being continuously updated, the full benefits of such systems will not be realized by the users, and the users might stop using them altogether.

The main objective of the proposed research is to understand the role of ongoing maintenance effort on an individual's process of decision making regarding her/his continued use of a HMIS. By developing and validating a model that explains the factors influencing an individual's continuance intention to use HMIS, the proposed study will pursue the following objectives: (i) to identify the various factors influencing HMIS continued use intention; (ii) to investigate the role of perceived maintenance effort in the above model; and (iii) to investigate the impact of individual characteristics (age, sex, Internet experience, education and conscientiousness) on the relationships in the proposed model.

This paper is organized as follows: first, the proposed research model is presented in section 2 along with theoretical background and hypotheses. Then, details of the proposed research methodology are presented in section 3. Finally, the potential contributions of this research are presented and discussed in section 4.

2 THEORETICAL BACKGROUND AND RESEARCH MODEL

The Expectation-Confirmation Model (ECM) proposed by Bhattacherjee (2001) will be used as a base for conceptualizing a research model for this study. ECM is one of the earliest and most commonly adopted theoretical models of IS continuance (i.e. IS continued use). ECM is based on the expectation-confirmation model (Oliver 1980), and it was further refined using empirical findings from IS use research (Bhattacherjee 2001). ECM is intended to evaluate an individual's continuance in system use and asserts that determinants of IS continuance are perceived usefulness and user satisfaction which, in turn, are influenced by the user's confirmation of his/her prior expectations regarding the use of the system. The proposed research model of this study (Figure 1) incorporates all of the constructs and relationships of ECT as well as other constructs and relationships required to investigate the role of perceived maintenance effort associated with using a HMIS as explained in the previous section. The proposed research model and associated hypotheses with appropriate theoretical support are presented and explained below.

Continuance Intention: Bhattacherjee (2001) defines IS continuance intention in the ECT as an individual's intention to continue using an information system (in contrast to initial use or acceptance). Continuance intention has been shown to be highly correlated with actual IS continuance (Bhattacherjee 2001) and is used as the endogenous construct in the proposed model. Continuance intention becomes more important for HMIS systems because, as explained in the introduction section, such systems typically have some benefits that could only be realized in the long run. Several antecedents have been shown to impact continuance as explained below.

Satisfaction: Satisfaction is defined as "a psychological or affective state related to and resulting from a cognitive appraisal of the expectation-performance discrepancy" (Bhattacherjee 2001). ECT asserts that an individual's satisfaction with IS use positively influences his/her continuance intention. Thus, the following is hypothesized for the context of HMIS:

H1: Higher levels of an individual's satisfaction with using a HMIS will positively influence his/her continuance intention to use the system.

Confirmation: Confirmation is defined as the extent to which an individual believes that his/her expectations regarding the performance of a particular information system is confirmed (Bhattacherjee 2001). ECT holds that confirmation positively influences satisfaction of an individual regarding the use of a particular information system (Bhattacherjee 2001). This should hold true in the case of HMIS as well. Thus, we hypothesize that;

H2: Higher levels of an individual's confirmation regarding the performance of a HMIS will positively influence his/her satisfaction with using the system.

Perceived Usefulness (PU): Perceived usefulness is defined as the degree to which a person believes that using a particular system would enhance his/her performance in the task that the system is

designed for (Davis 1989). Davis (1989) has shown the positive influence of PU on initial adoption of an information technology in his technology acceptance model. Furthermore, Venkatesh et al. (2003) were able to show that this effect does not significantly diminish as the person uses the system over time. In addition, ECM holds that an individual's IS continuance intention is determined by his/her perceived usefulness of the particular system (Bhattacharjee 2001). All of this is still applicable in the case of HMIS. Therefore, the following is hypothesized:

H3: Higher levels of an individual's perceived usefulness of a HMIS will positively influence his/her continuance intention to use the system.

ECT also holds that an individual's satisfaction regarding the use of an information system is determined by perceived usefulness. Similarly, perceived usefulness is determined by the individual's confirmation of his/her initial expectations. Therefore, the following is hypothesized:

H4: Higher levels of an individual's perceived usefulness of a HMIS will positively influence his/her satisfaction with using the system.

H5: Higher levels of an individual's confirmation regarding the performance of a HMIS will positively influence his/her perceived usefulness of the system.

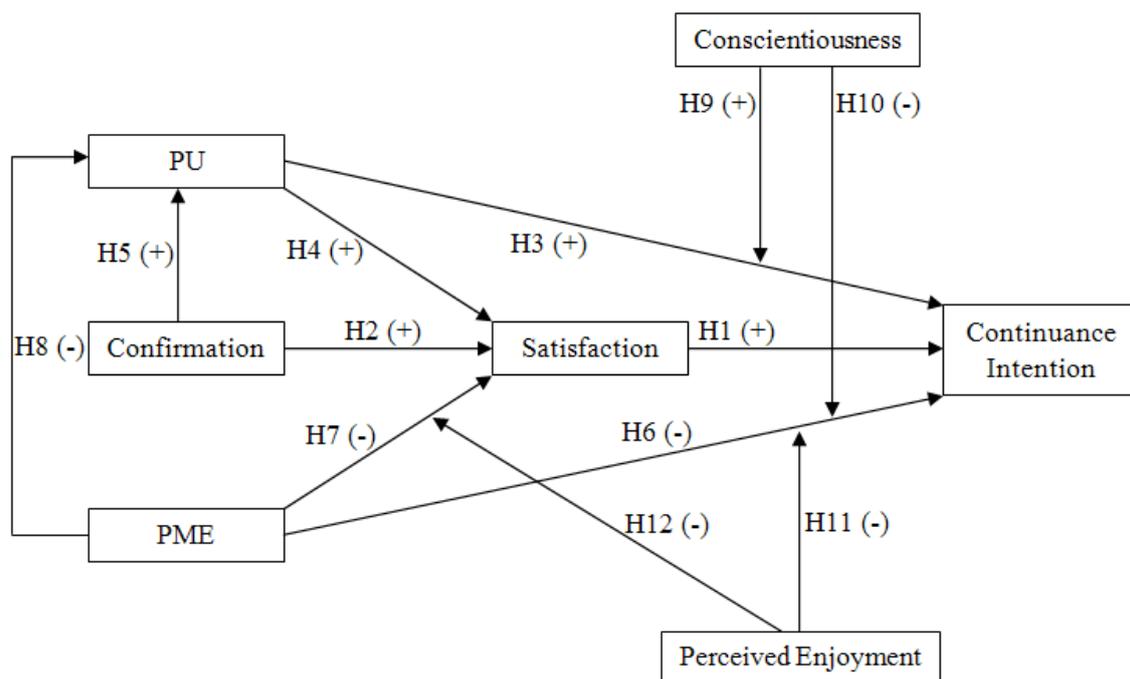


Figure 1. Proposed research model (PU: Perceived Usefulness; PME: Perceived Maintenance Effort)

Perceived Maintenance Effort (PME): The act of maintaining a HMIS can entail costs as an expense of time and effort similar to any other regular activity (Ba et al. 2001; Markus 2001). Furthermore, the time required for performing a regular activity can also be considered a lost opportunity cost (Orlikowski 1993). Unless accompanied with valuable potential benefits for the individual, such effort can impede technology adoption (Agarwal 2000; Kankanhalli et al. 2005). As explained in Section 1 (Introduction) numerous studies have shown that an individual's expectation regarding the effort required to use an IS determines their initial acceptance of that system. The impact of such effort expectancy on system usage will diminish as time goes by and users gain experience in operating the system (Davis et al 1989; Venkatesh et al. 2003; Bhattacharjee 2001). However, in the context of HMIS we argue that the effect of the regular and ongoing effort required for maintaining the system is unlikely to decrease over time. Therefore, there is a need to augment ECM for the class of HMIS with

a new construct that captures the type of ongoing effort required for maintaining such systems. Hence, the following is hypothesized:

H6: *Higher levels of an individual's perceived maintenance effort of a HMIS will negatively influence an individual's continuance intention to use the system.*

Prior research suggests that the effort required to use an information system can be seen as a factor that negatively influences end-user satisfaction (Eason 1988; Park and Lim 1999). As explained earlier, effort associated with using a HMIS may have two facets. First, effort required for learning to operate the system (i.e., perceived ease of use) was not included in ECT since the user perceives less effort in using the system over time. In contrast, the second form of effort, effort required for maintaining a HMIS (i.e., PME), is unlikely to diminish over time. Thus, the following is hypothesized:

H7: *Higher levels of an individual's perceived maintenance effort of a HMIS will negatively influence his/her satisfaction with using the system.*

Davis et al. (1989) argue that improvements in "ease of use" of an information system may contribute to the usefulness of the system so that effort saved due to ease of using the system may enable a person to accomplish more work for the same effort. Several studies in the information systems literature have shown the positive impact of "perceived ease of use" on PU of a system (e.g., Davis et al. 1989). Despite their differences, "perceived ease of use" and PME are similar in that the above argument can be made for both. Thus, when using a HMIS, a higher maintenance effort could have been re-employed to enable the user to accomplish more tasks with the system. Thus, the following is hypothesized:

H8: *Higher levels of an individual's perceived maintenance effort of a HMIS will negatively influence his/her perceived usefulness of the system.*

Conscientiousness: Conscientiousness is defined as "the degree of organization, persistence, and motivation in a goal-directed behavior" (Devaraj et al. 2008). Conscientious personalities are motivated to perform better at their jobs in order to achieve higher levels in their jobs. A conscientious person who perceives an information system to be useful is more likely than a non-conscientious one to continue using that system in order to accomplish more tasks and achieve higher benefits (Devaraj et al. 2008). Therefore, the following is hypothesized:

H9: *The influence of perceived usefulness of a HMIS on continuance intention will be moderated by conscientiousness, such that the effect will be stronger for more conscientious personalities.*

An important characteristic of a conscientious personality is self-control and persistence in putting in the regular activity (similar to regular maintenance) that is required for satisfying the need for achievement (Costa et al. 1991). In other words, conscientious persons are more likely to perform the regular effort required to use a HMIS. Thus, the following is hypothesized:

H10: *The influence of perceived maintenance effort of a HMIS on continuance intention will be moderated by conscientiousness, such that the effect will be weaker for more conscientious personalities.*

Perceived Enjoyment: Perceived enjoyment is defined as "the extent to which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated" (Davis et al. 1992). Lin et al. (2005) added a similar construct (playfulness) to ECM and were able to show that playfulness impacts both satisfaction and continuance intention positively in a web portal context. Therefore, it is reasonable to expect that perceived enjoyment will reduce the negative impact of PME on satisfaction and continuance intention of a HMIS. Thus, the following hypotheses are made:

H11: The influence of an individual's perceived maintenance effort of a HMIS on continuance intention will be moderated by her/his perceived enjoyment in using the system, such that the effect will be weaker for individuals who perceive more enjoyment in using the system.

H12: The influence of an individual's perceived maintenance effort of a HMIS on satisfaction will be moderated by her/his perceived enjoyment in using the system, such that the effect will be weaker for individuals who perceive more enjoyment in using the system.

3 RESEARCH METHODOLOGY

This section explains in detail the major parts of the proposed research methodology to validate the proposed model including the research context and data collection, pilot study, measurement instrument, qualitative data analysis, model validation, impact of individual characteristics, post-hoc analyses.

Research context and data collection: The proposed research model will be empirically validated through a survey study involving individuals using a HMIS. Surveys are the typical approach to empirically validate adoption models (Webster and Trevino, 1995). Data collection for the study will be performed at one point in time using a survey to gather measurement scales for the model factors. Individual characteristics (demographics, details of previous computer and Internet use) will also be collected at this point. The study will be conducted at the authors' university, and the survey will be targeted at university students, staff and faculty members. For the purposes of this study, the social networking website Facebook¹ will be employed as an instance of a HMIS. Facebook is characterized by the main specification of HMIS indicated in the introduction section of this paper. Using Facebook requires an ongoing effort in the form of social interaction, communication and profile updating (Ellison et al. 2007). In addition, it may have benefits in the form of social capital that is mostly realized by the user over a long term (Ellison et al. 2007).

Prior to starting this research study, a research ethics protocol will be prepared and submitted to the authors' university research ethics board that is responsible for reviewing and approving research studies involving human subjects.

Pilot study: Prior to the data collection for the main study, a pilot study involving 30 Facebook users will be performed. The pilot will also have a survey design conducted at the same university intended for the main data collection. Participants of the pilot study will be asked to fill out the survey containing the model measures as well as demographic-related questions. Results from the pilot study will be used to assess and refine the measurement scales used for the constructs in the proposed model, as well as to identify and resolve any possible technical problems with the study's procedures (e.g., participant recruitment, etc.).

Measurement instruments: In order to ensure content validity, measurement scales for all constructs in the proposed model except for PME are selected from the extant literature (Table 1). Scales are slightly adapted in some cases to reflect the context of this study. For example, the name of the specific system in question has been changed to "Facebook" and the specific task in question has been changed to "online social networking". A new measurement scale for perceived maintenance effort will be devised following the methodology suggested by Moore and Benbasat (1991). In order to do so, an existing measure for regular knowledge codification effort (Kankanhalli et al. 2005) will be used as the basis for developing the scale for PME.

Qualitative analysis: Participants will also be asked to respond to open-ended questions relating to their experience and concerns with using Facebook as well as their perceptions regarding the regular maintenance effort required while using the system. Subject responses to open-ended questions will be analyzed using content analysis techniques (word frequency) in order to identify particular patterns and themes in the data (Morgan 1988) as well as to enhance the robustness of results and to strengthen

¹ (www.facebook.com)

the findings through triangulation (Benbasat et al. 1987). Triangulation involves validating the results by combining a range of research methods (Tashakkori and Teddlie 1998).

Construct	Reference(s)	Items
Continuance Intention	Bhattacharjee (2001)	7-Point Likert scale ranging from “strongly disagree” to “strongly agree”: <ol style="list-style-type: none"> 1. I intend to continue using Facebook rather than discontinue its use. 2. My intentions are to continue using Facebook than use any alternative social networking site. 3. I would like to discontinue my use of Facebook (reverse coded).
Perceived Usefulness	Davis et al. (1989)	7-Point Likert scale ranging from “strongly disagree” to “strongly agree”: <ol style="list-style-type: none"> 1. Using Facebook improves my performance in online social networking. 2. Using Facebook increases my productivity in online social networking. 3. Using Facebook enhances my effectiveness in online social networking. 4. Overall, Facebook is useful for online social networking.
Perceived Maintenance Effort	Kankanhalli et al. (2005)	A new 7-point Likert scale will be developed for this construct as explained in the methodology section. Below are some examples of related items found in the literature which are slightly adapted to fit the context of the proposed study: <ol style="list-style-type: none"> 1. I do not have the time to maintain my social network using Facebook. 2. It is laborious to maintain my social network using Facebook. 3. The effort is high for me to maintain my social network using Facebook. 4. I am worried that if I become active on Facebook that I will have to spend additional time maintaining follow up communications. 5. I am afraid that my activities on Facebook will evoke additional clarifications or communications.
Satisfaction	Bhattacharjee (2001)	7-Point semantic differences: How do you feel about your overall experience of Facebook use: <ol style="list-style-type: none"> 1. Very dissatisfied/Very satisfied. 2. Very displeased/Very pleased. 3. Very frustrated/Very contented. 4. Absolutely terrible/Absolutely delighted.
Confirmation	Bhattacharjee (2001)	7-Point Likert scale ranging from “strongly disagree” to “strongly agree”: <ol style="list-style-type: none"> 1. My experience with using Facebook was better than what I expected. 2. The service level provided by Facebook was better than what I expected. 3. Overall, most of my expectations from using Facebook were confirmed.

Construct	Reference(s)	Items
Conscientiousness	John et al. (1991)	7-Point Likert scale ranging from “strongly disagree” to “strongly agree”: I see myself as someone who... 1. ...does a thorough job. 2. ...can be somewhat careless (reverse). 3. ...is a reliable worker. 4. ...tends to be disorganized. 5. ...tends to be lazy (reverse). 6. ...perseveres until the task is finished. 7. ...does things efficiently. 8. ...makes plans and follows through with them. 9. ...is easily distracted.
Perceived Enjoyment	van der Heijden (2004)	7-Point semantic differences: How do you feel about your overall experience of Facebook use: 1. Enjoyable/Disgusting. 2. Exciting/Dull. 3. Pleasant/Unpleasant. 4. Interesting/Boring.

Table 1. Measurement scales for the constructs in the proposed model.

Model validation: Structural Equation Modeling (SEM) will be used to validate the proposed model of this study. SEM allows the analysis and investigation of unobservable variables that are indirectly measured from observable variables (Chin 1998). In particular Partial Least Squares (PLS) will be used as it is applicable to both exploratory and confirmatory research which is appropriate for this study (Chin et al. 2003; Gefen et al. 2000). Further, PLS gives optimum prediction accuracy because of its prediction orientation (Fornell and Cha 1994). The measurement model in PLS will be assessed in terms of item loadings, internal consistency and discriminant validity (Gefen et al. 2000) using SmartPLS software.

Impact of individual characteristics: In order to investigate the impact of individual characteristics on HMIS usage, the following statistical technique will be employed. The impact of age, sex, education level and Internet use experience will be examined by creating a series of control models. To this end, for each of the above variables, one construct will be added to the model and additional paths will be created from the new construct (e.g., Level of education) to all the other constructs in the model. Then, the variance explained for the constructs in the original model and the controlled models will be compared in order to investigate whether there is a significant difference due to specific individual characteristics.

Post-hoc analyses: By performing mean and standard deviation analyses, participants who used the system more frequently and extensively will be compared with those who used it less frequently in order to investigate any significant the difference in their perceived maintenance effort. Frequency and extent of usage will be measured by asking participants to self-report their degree of current usage of Facebook on a six-position categorical scales with boxes labeled "Don't use at all," "Use less than once each week," "Use about once each week," "Use several times a week," "Use about once each day," and "Use several times each day" (Davis et al. 1989). Moreover, other possible relationships which are not hypothesized in the proposed model of this study will also be examined through a saturated model analysis (Chin et al. 2003). In addition, any possible interaction effects between independent variables will be examined using PLS as suggested by Gefen et al. (2000). Furthermore, possible moderation effects of individual characteristics will be examined. Finally, the effect size of antecedents of continuance intention to use Facebook on continuance intention will be determined as suggested by Chin (1998).

Sample: The sample size required for validating a model in PLS is determined by the maximum of 10 times the most number of paths leading to a construct and 10 times the number of items for the most

complex construct in the proposed model (Chin et al. 2003). Conscientiousness is measured using the most number of items (9) in the proposed model resulting in a minimum required sample size of 90. To allow for possible spoiled surveys, 200 participants will be recruited. A balance in the recruitment of participants regarding their individual characteristics will support the data analysis pertaining to the role of such characteristics on the proposed model. Venkatesh et al. (2003) showed that the impact of ease of use on usage was diminished after six months since the users started using the system. As the proposed research is not concerned with initial use of the system, participants will be users with more than six months of experience in using Facebook. Invitations to participate in the main study will be posted on university bulletins and will be sent by e-mail to the university members. Potential recruits will be encouraged to participate by having their email addresses entered into a draw for a chance to win one of five available \$20 prizes. In order to ensure confidentiality, collected email addresses will not be linked to survey responses.

4 EXPECTED CONTRIBUTIONS

From an academic perspective, results of this research will contribute to the IS literature by developing a continuance intention model specific to HMIS systems. It is hoped that this research will attract the attention of researchers to further develop and test constructs and models applicable to this class of information systems. More specifically, the proposed research model makes a distinction between the effort required to learn to operate the system (ease of use or effort expectancy) and the effort required to maintain the system (maintenance effort). Such distinction is not reported in the IS adoption literature.

As with any research, this work has some potential limitations. First, the proposed study will be carried out in a Canadian context. As such, the findings will not be immediately transferrable to other countries with different demographic and cultural characteristics. Thus more research will be required before generalizing our potential findings to those contexts. Second, this study will be conducted using a specific instance of HMIS (Facebook) that exhibits the typical characteristics of such systems. This is a limitation in terms of generalizability as Facebook also embodies some unique characteristics that may not be shared with other HMIS. For instance Facebook is certainly more hedonic in nature compared to a PHR system. Thus, further research is needed to determine the extent to which the potential findings from this study can be extended to less hedonic HMIS. We attempt to partially diminish this limitation by studying the moderating role of enjoyment on the appropriate relations in the model.

Practitioners will also gain a better understanding of user preferences in using HMIS through this work, resulting in practical guidelines for HMIS development, promotion and use. Results from this research can help direct attention to the most influencing adoption factors while proposing solutions that mitigate user resistance. Technology providers will benefit by informing the design of their proposed systems based on these results. This, in turn, will lead to higher rates of adoption and success of HMIS. Given the growing importance of such systems, adoption studies of this nature are both timely and relevant.

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