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Expectation-Confirmation Model of Information System Continuance: A Meta-Analysis

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***Abstract*—**The expectation-confirmation model (ECM) is one of the most widely used models for evaluating information system continuance, and this model has been extended to other study backgrounds, or expanded with other theoretical perspectives. However, combining ECM with other theories or investigating the background problem may produce some disparities, thus generating inaccurate conclusions. Habit is considered to be an important factor that influences the user's continuance behavior. This paper thus critically examines seven pairs of relationships from the original ECM and the habit variable. A meta-analysis was used to tackle the development of ECM research over the last 10 years from a range of journals and conference papers published in 2005–2014. Forty-six journal articles and 19 conference papers were selected for analysis. The results confirm our prediction that a high effect size for the seven pairs of relationships was obtained (ranging from r=0.386 to r=0.588). Furthermore, a meta-analytic structural equation modeling was performed to simultaneously test all relationships. The results show that habit had a significant positive effect on continuance intention at $p<=0.05$ and that the six other pairs of relationships were significant at $p<0.10$. Based on the findings, we refined our original research model and an alternative model was proposed for understanding and predicting information system continuance. Some theoretical implications are also discussed.

***Keywords*—**Expectation-confirmation theory, expectation-confirmation model, meta-analysis, meta-analytic structural equation modeling.

I. Introduction

THE expectation-confirmation theory (ECT) is often used for assessing and measuring consumer satisfaction of products or services and post-purchase behavior. Using context modification adjustment in information systems, Bhattacherjee [1] modified ECT, renaming it ECM of information system continuance. The ECM has often been used to explain continuance behavior in information systems, for example, Lin et al. [2] employed the value-based adoption model and ECT to conduct the continuous usage intention of Internet protocol television. Lin et al. [3] integrated perceived playfulness into ECT to understand web portal continuance intention. Larsen et al. [4] combined task-technology fit theory and ECT to explain users' information system continuance intention. These studies have proven the ECT model's maturity and applicability in investigating users' continuance behavior regarding information systems. These studies may have used ECM directly, applied it to different study scenarios, and expanded the field by combining it with other theories; however, they may contain disparities because there are some differences in the study scenarios or differences relating to investigating the research problem, which can result in inaccurate conclusions. It is thus necessary to conduct a meta-analysis of ECM.

The objectives of the meta-analysis is to arrange all previous studies into a systematic integration, analyzing and simplifying the data, aggregating them into a summary, and arriving at a more objective, quantifiable standard to compensate for the lack of a traditional literature review. A meta-analysis can thus help us identify potential moderating factors. An analysis of these moderating factors can help researchers to spot shortcomings in their studies and can point toward a future research direction [5]. In summary, in this study, a meta-analysis is defined as: an accumulation of individual studies into a systematic integration for the purpose of analyzing them using more objective and quantifiable standards and aggregating the data into a summary in order to demonstrate more reliable results.

Glass [6] maintained that a meta-analysis is a statistical analysis of a large collection of analytical results from individual studies for the purpose of integrating the findings and ascertaining their common points in relation to the rapidly expanding research literature. A meta-analysis can be divided into two parts: significance tests and effect size calculations. Significance tests investigate the integration of all the study results; they test whether the significance level can reject the null hypothesis, usually using the z value, *p* value, or the average effect size to calculate the confidence interval. The other part is the estimation of the effect size, which represents the relation of strength between the variables. In general, we can use Pearson's r, Fisher's Zr, Glass' Δ, Cohen's d, or Hedges' g to represent unbiased estimates. Zhang et al. [5] suggested that although the meta-analysis method continues to encounter problems such as "oranges and apples," many studies have proven that it is a robust and rigorous research method.

The purposes of this study are to understand ECM and its major expansion of variable (in our study, habit) and to investigate it based on abundant previous research in relation to continuance intention.

II. The History of Expectation-Confirmation Theory

Proposed by Oliver [7], ECT is a basic theory of consumer satisfaction. Its main premise relates to the comparison between pre-purchase expectation and post-purchase perceived performance as a means to determine consumer satisfaction of a product or service; satisfaction is thus the antecedent of

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repurchase intentions. After some time using the product or service, a consumer will gain experience and understanding of the performance of the product or service, forming a new cognition. The consumer will compare this new cognition with his or her initial expectation to ascertain whether the assessment is identical, which is called confirmation. When consumer expectation is lower than the actual performance of the product or service cognition, the result is a positive confirmation; when the expectation is higher than the actual performance of the product or service cognition, the result is a negative confirmation [1]. The confirmation level affects consumer satisfaction, and the satisfaction level affects consumer repurchase intention [7].

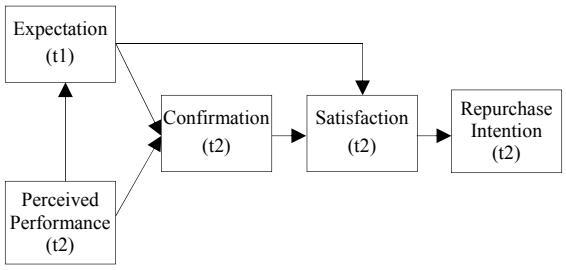


Fig. 1 ECT

As shown in Fig. 2, Bhattacherjee [1] proposed ECM in the IS context. The expectation construct is replaced by post-usage perceived usefulness. Confirmation is the extent to which the user's expectation is confirmed, and satisfaction is the user's level of satisfaction in the IS. ECM is applied in the IS context, and the repurchase intention is renamed as the IS continuance intention.

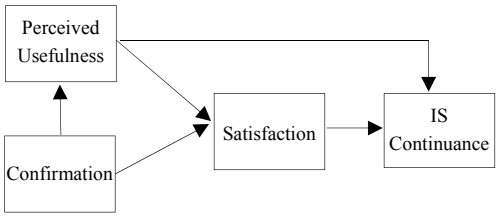


Fig. 2 ECM of information system

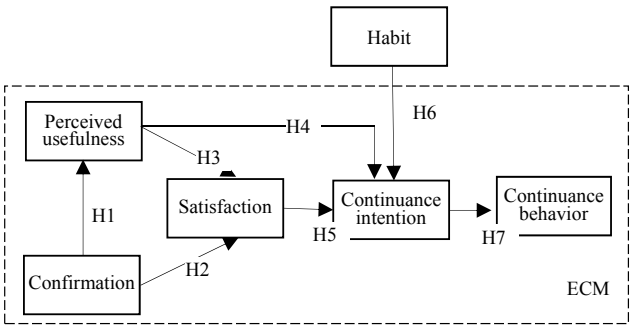


Fig. 3 Research model

TABLE I
VARIABLE DEFINITION

Variables	Definition	Source
Perceived usefulness	The extent to which a person believes that using a particular information system will enhance his or her job performance	[8]
Confirmation	Users' perceptions of the congruence between the expectation of information system usage and its actual performance	[1]
Satisfaction	Users' affect with feelings about the prior use of the information system	[1]
Continuance intention	Users' intention to continue using the information system	[1]
Continuance behavior	Users' actual usage behavior regarding the information system	[8]
Habit	The extent to which people automatically use a particular information system in response to a specific situation.	[9]

III. RESEARCH MODEL

We focused on six pairs of original ECM relationships and one pair of extended ECM relationships. Fig. 3 and Table I show the research model and the definitions of the research variables.

IV. RESEARCH METHODOLOGY

A. Sample

The study included journal and conference papers published in 2005 to 2014. The journal articles were acquired from four databases: ABI/INFORM Complete, EBSCOHost, ScienceDirect (SDOL), and IEL (IEEE Xplore). The conference papers were acquired from five internationally renowned information systems conference: the Hawaii International Conference on System Sciences (HICSS), the European Conference on Information Systems (ECIS), the International Conference on Information Systems (ICIS), the Americas Conference on Information Systems (AMCIS), and the Pacific Asia Conference on Information Systems (PACIS). The keywords used in the searches were: "IS continuance," "post-adoption model," "continued usage," and "expectation-confirmation." The study sought to locate all journal and conference papers with a direct correlation (titles or keywords containing the above keywords and mainly discussing post acceptance in IS continuance) and an indirect correlation (titles or keywords that did not include the above keywords but mainly discussed post acceptance in IS continuance) as long as they met the above criteria and that they were empirical studies providing correlation matrices between variables and sample size. When a study appeared in the dataset both as a journal and a conference paper, the journal paper was selected. When two studies used the same dataset, one paper was chosen. Alternatively, when a study reported multiple datasets, they were considered as two studies. The final sample included 46 journal articles and 19 conference papers. Table II shows the publication outlets of the 65 studies in the meta-analysis.

TABLE II
PUBLICATION OUTLETS OF THE 65 STUDIES IN THE META-ANALYSIS

Publication outlet	Count of papers
Journal	
African Journal of Business Management	1
AIS Transactions on Human-Computer Interaction	2
Behaviour & Information Technology	5
Communications of the Association for Information Systems	1
Computers & Education	5
Computers in Human Behavior	2
Cyberpsychology, Behavior, and Social Networking	1
Decision Support Systems	1
Electronic Markets	1
Electronic Commerce Research and Applications	1
European Journal of Information Systems	4
Expert Systems with Applications	1
Group Decision and Negotiation	1
Information & Management	3
Information Systems and e-Business Management	2
Information Technology and Management	1
International Journal of Electronic Business Management	1
International Journal of Electronic Commerce	1
International Journal of Human-Computer Studies	3
International Journal of Information Management	3
Journal of Computer Information Systems	3
Journal of The American Society for Information science and Technology	1
Journal of the Association for Information Systems	1
Telecommunications Policy	1
Total	46
Conference	
Hawaii International Conference on System Sciences (HICSS)	4
European Conference on Information Systems (ECIS)	3
International Conference on Information Systems (ICIS)	4
Americas Conference on Information Systems (AMCIS)	1
Pacific Asia Conference on Information Systems (PACIS)	7
Total	19

B. Coding Procedure

Intercoder reliability was very important in the meta-analysis. In order to improve the reliability regarding coding and to reduce errors caused by subjective judgment, two coders collaboratively established the meta-analysis coding table. Consequently, based on the content of the article, one coder studied the research problem, and the completeness of the information provided by the articles was then considered in terms of whether it would be included in the literature samples. Following the literature search and collection, two coders conducted the article coding and coded and registered the year of the articles, the study variable, the sample size, the country, the statistics, etc. At this stage, it was important to pay attention to the following: Avoid comparing the apples and oranges variable problem as well as the coders' subjective judgment. Therefore, our study comprised two coders who collaboratively established the sample document coding principle and ensured that different study results were compared on the same basis. In the event that a different classification result was obtained, the two coders engaged in discussion to arrive at a decision. If they were still unable to reach a common understanding, they sought help from another expert to categorize it. At this stage, we paid particular attention to avoid registering the same study research twice, for example, for articles published in conference proceedings as well as in a journal, those from the journal assumed priority.

C. Data Analysis

The most commonly used effect size theory was proposed by [6], [10]-[12]; however, it contains advantages and disadvantages. This present meta-analysis study used r, g, Glass' Δ, or other estimating effect size formula, which was important to express the effect size sample of the study [11]. The study used Pearson's correlation as a basis for representing effect size because a significant amount of statistical data can easily be converted into correlation coefficients using Rosenthal's [11] meta-analysis technology and methods and converting r into Fisher's Zr value. The meta-analysis was calculated using the comprehensive meta-analysis V2.0 software.

V. RESULTS

A. Correlation Analysis

To conduct the meta-analysis, Pearson's correlation coefficient (r) was used as the effect size. The magnitude of the effect size was applied according to Hemphill's [13] guidelines: $r<0.20$ was considered a low effect size magnitude; $r=0.20$ to 0.30 were considered medium effect size magnitudes; and $r>0.30$ was considered a high effect size magnitude. As shown in Table III, a high effect size was obtained for all seven pairs of relationships (ranging from $r=0.386$ to $r=0.588$). Homogeneity analyses were conducted using Q and I^2 statistics [14]. Table III shows that the assumption of within-study heterogeneity of the effect size was supported; all Q values were significant ($p<0.05$). For the meta-analysis, we selected a random effect model because there were within-study errors (sampling or estimation) and between-study variances. Each study obtained different effect sizes. We wanted to ensure that all these effect sizes (and not just one effect estimate) were presented in the summary estimate [14]. Publication bias was judged using fail-safe N values, which represented the number of included unpublished studies of the same relationship that refuted significant meta-analytic results. All seven pairs of relationships passed the fail-safe N at the 0.05 level.

TABLE III
SUMMARY OF MEAN EFFECT SIZE

Path	K	N	r	95%CL	Z	Heterogeneity test	
						Q	I^2%
H1	54	21604	0.502	0.443/0.556	14.365***	1597.05***	86.52
H2	60	23091	0.580	0.523/0.632	15.881***	2260.63***	97.39
H3	54	21377	0.485	0.406/0.557	10.520***	2739.07***	98.07
H4	51	19915	0.560	0.520/0.597	22.301***	736.68***	93.21
H5	58	19740	0.565	0.502/0.622	14.286***	2321.83***	97.55
H6	9	2645	0.588	0.538/0.633	18.311***	26.936**	70.30
H7	4	1235	0.386	0.242/0.513	4.979***	22.251***	86.52

*** p< 0.001; ** p< 0.01; K: Total number of studies; N: Total sample size; r: mean effect size

B. Meta-Analytic Structural Equation Modeling

Meta-analytic structural equation modeling (MASEM) combines meta-analysis with structural equation modeling [15]. MASEM was used to integrate bivariate relationships from different primary-level studies, providing a significant basis for the quantitative synthesis of the research findings [16]. We analyzed the relationships among the research variables using LISREL 8. The meta-analytic correlations among the variables were synthesized into a pooled correlation matrix, and the sample size was calculated using the arithmetic mean (N=376). These two values were used as inputs for testing the MASEM, as shown in Table IV. The standardized path coefficients for the research model and the explained variance percentages are shown in Fig. 2. The model achieved a limited model fit index – according to goodness-of-fit (GFI), adjusted goodness-of-fit (AGFI), comparative fit (CFI), normed-fit (NFI), and the standardized root mean square residual (SRMR) – as follows: χ^2=64.37, df=7, p>0.05, GFI=0.91; AGFI=0.73; CFI=0.91; NFI=0.91; SRMR=0.12. The recommended values for GFI, AGFI, CFI, and NFI was greater than 0.90; the recommended value for SRMR was less than 0.08, whereby a SRMR close to 0 indicates a perfect fit. The MASEM coefficients of the original model are shown in Fig. 4. Of the seven pairs of relationships in our proposed research model, habit had a significant positive effect on continuance intention at p<=0.05, and the six others were significant at p<0.10.

According to SEM, software such as LISREL provide modification indices (MI) that estimate differences in the model fit χ^2 for a possible additional path to improve the model fit [17]. In addition, the MASEM approach is useful because of its ability to test previously unconsidered relationships in previous meta-analytical syntheses [16]. We added three paths to the research model: the effect of perceived usefulness on habit (MI=57.60); the effect of confirmation on habit (MI=47.76); and the effect of satisfaction on continuance behavior (MI=29.91). The revised model showed a better statistical model fit (χ^2=25.94, df=5, p>0.05, GFI=0.98; AGFI=0.91; CFI=0.98; NFI=0.91; SRMR=0.046). Fig. 5 shows that all the paths in the revised model achieved statistical significance at the 0.05 level.

TABLE IV
META-ANALYTIC CORRELATION MATRIX

	1	2	3	4	5	6
1. Confirmation	1					
2. Usefulness	0.502	1				
3. Satisfaction	0.580	0.485	1			
4. Intention	0.506	0.560	0.565	1		
5. Habit	0.536	0.556	0.490	0.588	1	
6. Behavior	0.402	0.351	0.438	0.386	0.324	1

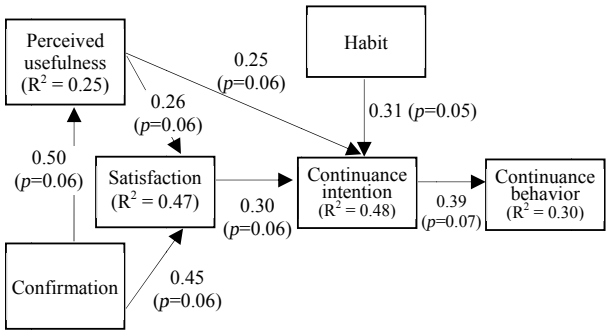
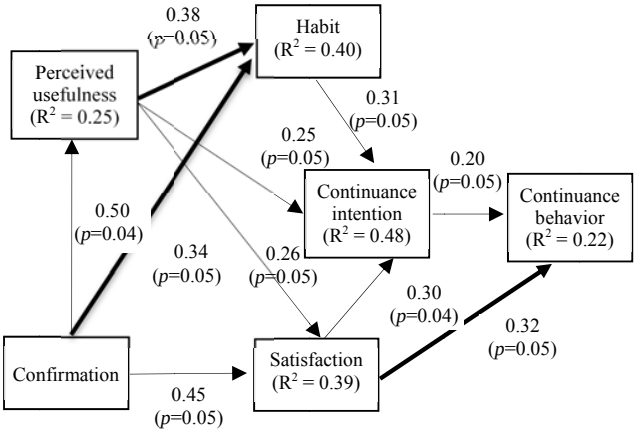


Fig. 4 Results for the original model



Thick lines indicate the additional paths; variance explained in parentheses.

Fig. 5 Results for the revised model

VI. DISCUSSION

Ever since Bhattacherjee [1] applied ECM to information systems, many researchers have adopted this theoretical model in information system continuance, extended it to other study

backgrounds, or expanded it in combination with other theoretical perspectives. This level of activity has thus produced a significant number of study results. We focused on six pairs of original ECM relationships and one pair of extended ECM relationships and explored the 2005 to 2014 timeframe. Given that we found a poor model fit in our proposed model, MI was used to improve the results. Following this, three additional paths were included. The total effects of the revised model are reported in Table V. According to our results, satisfaction was predicted primarily by confirmation and secondarily by perceived usefulness. In order of relative importance, continuance intention was predicted by confirmation, perceived usefulness, habit, and satisfaction. In order of relative importance, continuance behavior was predicted by satisfaction, confirmation, continuance intention, perceived usefulness, and habit. Habit was predicted primarily by confirmation and secondarily by perceived usefulness.

TABLE V
TOTAL EFFECTS FOR REVISED STRUCTURAL MODEL

Antecedents	Total effects on satisfaction	Total effects on continuance intention	Total effects on continuance behavior	Total effects on habit
Perceived usefulness	0.26, p=0.05	0.44, p=0.04	0.17, p=0.03	0.38, p=0.05
Confirmation	0.58, p=0.04	0.46, p=0.04	0.28, p=0.03	0.54, p=0.03
Satisfaction		0.30, p=0.04	0.38, p=0.05	
Habit		0.31, p=0.05	0.06, p=0.02	
Continuance intention			0.20, p=0.05	

VII. IMPLICATIONS AND LIMITATIONS

The results of this study have implications for research. First, the original ECM and habit have been comprehensively studied in the information system continuance literature, however, the causal relationship and relative importance of the variables is not well understood. The confirmation of the causal paths between the original ECM and habit was achieved by including three additional paths (perceived usefulness → habit, confirmation→ habit, satisfaction → continuance behavior). This study thus contributes to the theoretical development of the existing information system continuance literature by adding the three relationships in interpreting and predicting continuance behavior in the context of information system usage. Second, there has been considerable research regarding continuance intention and/or habit in continuance behavior. This study found the salience of both continuance intention and satisfaction in information system continuance behavior, thus highlighting the important role of satisfaction in information system continuance behavior.

The results of this study also have implications for practice. First, the study found that confirmation was the strongest factor influencing satisfaction, continuance intention, and habit. A confirmed user, which implies the realization of expected benefits, is more likely to be satisfied with an information system, has a positive effect on continuance intention, and has a tendency to form habits. Organizations or system providers must ensure the provision of sufficient facilitating conditions such as training courses and personal assistants to avoid problems when using the system. Second, by reviewing the information system continuance literature and applying MASEM in the context of the information system, this study has supported and further proposed an alternative model for information system continuance. Our findings relating to the significant effects of perceived usefulness and confirmation on habit suggest that organizations should never neglect expected benefits by individuals from their initial system usage in order to allow these individuals to form their continuance habits. The study also found that satisfaction has a direct effect on continuance behavior. The results showed that the fulfillment of individuals' expectations regarding system usage directly influence their continuance behavior.

This study does have some limitations. First, we integrated the habit variable into the original ECM. Future research can explore additional expansion variables in ECM, including their suitability. Second, ECM was regarded as an applied structure for predicting and explaining the continuance usage of some kind of information system as well as country-wide studies (for example, east and west parts of the country) and different users (for example, staff and student). Our results present the possibility of the existence of moderators. Future research can focus on moderators so that the relationship between the variables can be made more explicit.

REFERENCES

[1] A. Bhattacherjee, "Understanding information systems continuance: An expectation-confirmation model," *MIS Quarterly*, vol. 25, no. 3, pp. 351-370, 2001.
[2] T. C. Lin, S. Wu, J.S. C. Hsu, and Y. C. Chou, "The integration of value-based adoption and expectation–confirmation models: An example of iptv continuance intention," *Decision Support Systems*, vol. 54, no. 1, pp. 63-75, 2012.
[3] C.S. Lin, S. Wu, and R.J. Tsai, "Integrating perceived playfulness into expectation-confirmation model for web portal context," *Information & Management*, vol. 42, no. 5, pp. 683-693, 2005.
[4] T.J. Larsen, A.M. Sørebø, and Ø. Sørebø, "The role of task-technology fit as users' motivation to continue information system use," *Computers in Human Behavior*, vol. 25, no. 3, pp. 778-784, 2009.
[5] L. Zhang, J. Zhu, and Q. Liu, "A meta-analysis of mobile commerce adoption and the moderating effect of culture," *Computers in Human Behavior*, vol. 28, no. 5, pp. 1902-1911, 2012.
[6] G.V. Glass, "Primary, secondary and meta-analysis of research," *Educational Researcher*, vol. 5, no. 10, pp. 3-8, 1976.
[7] R.L. Oliver, "A cognitive model of the antecedents and consequences of satisfaction decisions," *Journal of Marketing Research*, vol. 17, no. 4, pp. 460-469, 1980.
[8] F.D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Quarterly* vol. 13, no. 3, pp. 319-340, 1989.
[9] M. Limayem, S.G. Hirt, and C.M.K. Cheung, "How habit limits the predictive power of intention: The case of information systems continuance," *MIS Quarterly*, vol. 31, no. 4, pp. 705-737, 2007.
[10] L.V. Hedges and I. Olkin, *Statistical methods for meta-analysis*. Orlando, FL: Academic Press. 1985, pp.
[11] R. Rosenthal, *Meta-analytic procedures for social research*. Beverly Hills: Sage Publications. pp.
[12] J.E. Hunter and F.L. Schmidt, *Methods of meta-analysis: Correcting error and bias in research findings*. Beverly Hills: Sage Publications. 1990, pp.
[13] J.F. Hemphill, "Interpreting the magnitudes of correlation coefficients," *American Psychologist*, vol. 58, no. 1, pp. 78-79, 2003.

[14] M. Borenstein, L.V. Hedges, J.P.T. Higgins, and H.R. Rothstein, *Introduction to meta-analysis*. United Kingdom: John Wiley & Sons Inc. 2009, pp.
[15] M.W.L. Cheung, *Meta-analysis: A structural equation modeling approach*. United Kingdom: John Wiley & Sons, Ltd. 2015, pp.
[16] D.D. Bergh, et al., "Using meta-analytic structural equation modeling to advance strategic management research: Guidelines and an empirical illustration via the strategic leadership-performance relationship," *Strategic Management Journal*, vol. 37, no. 3, pp. 477-497, 2016.
[17] D. Gefen, D. Straub, and M. C. Boudreau, "Structural equation modeling and regression: Guidelines for research practice," *Communications of the Association for Information Systems*, vol. 4, no. 1, pp. 1-79, 2000.