

December 2004

Hybrid Technology Acceptance Model: The Case of Object-Oriented Programming

Injai Kim
Dongguk University

Follow this and additional works at: <http://aisel.aisnet.org/pacis2004>

Recommended Citation

Kim, Injai, "Hybrid Technology Acceptance Model: The Case of Object-Oriented Programming" (2004). *PACIS 2004 Proceedings*. 96.
<http://aisel.aisnet.org/pacis2004/96>

This material is brought to you by the Pacific Asia Conference on Information Systems (PACIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in PACIS 2004 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

Hybrid Technology Acceptance Model: The Case of Object-Oriented Programming

Injai Kim

Department of Information Systems
College of Business Administration
Dongguk University, Seoul, Korea
ijkim@dongguk.edu

Abstract

The technology acceptance model (TAM) has been widely used for predicting behavioral processes involving information technologies. However, several previous studies point out that TAM may not effectively explain the adoption process of complex information technologies. This study manifests the limitations of TAM and suggests a new research model that incorporates the concept of perceived behavioral control from the theory of planned behavior into TAM. Further, this study compares the two models in the case of acceptance of object-oriented programming.

The results support the view that the perceived behavioral control concept should be employed to better predict the relationship between external variables and acceptance of the technology. Overall, the model developed in this study is significantly better than TAM in explaining the acceptance process of object-oriented programming. This study shows that length of training, organizational support, and personal experience are significant predictors of acceptance of object-oriented programming.

Keywords: Information Technology Acceptance, Object Orientation, Theory of Planned Behavior, Perceived Behavioral Control

1. The Proposed Model and Research Hypotheses

This research develops a new technology adoption model by incorporating the main concept of PBC of TPB into TAM. The difference between TAM and the new model is the placement of individual, managerial, and organizational variables. In the proposed model, the variables that were considered exogenous (preceding usefulness and the ease of use of technology) in the original model of TAM, are positioned to affect both the behavioral intention and actual behavior. Figure 1 presents a schema of the newly developed model.

1.1 OO Technology Acceptance

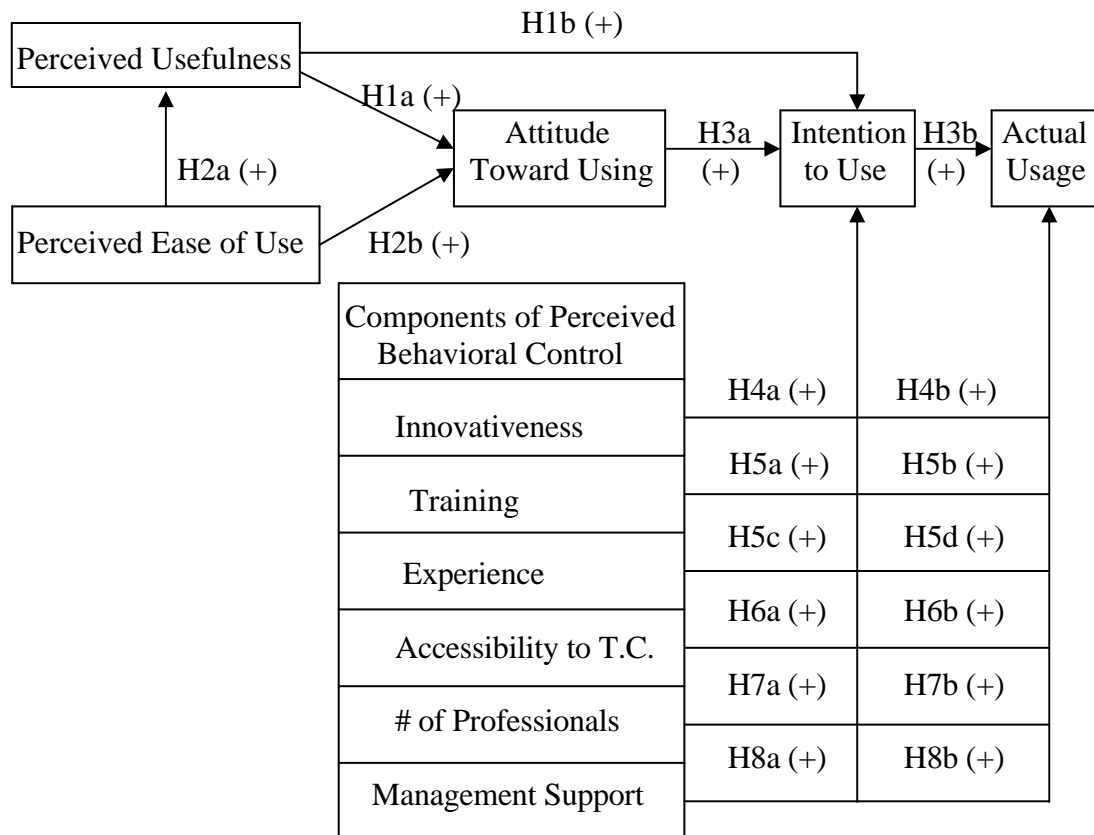
Researchers have found that user satisfaction (Montazemi, 1988; Raymond, 1985; Yap et al., 1992) and system usage (Adams et al., 1992; Davis et al., 1989; Straub et al., 1995; Szajna, 1996) are two primary indicators of technology acceptance. Considering that managers are interested in the practical value of system usage (Straub et al., 1995), this study uses the level of actual usage of object-oriented programming as a measure of acceptance of object-oriented programming.

1.2 Perceived Usefulness, Ease of Use, Attitude Toward Using, and Behavioral Intention

Perceived usefulness was defined by Davis (1989: p320) as “the degree to which a person believes that using a particular system would enhance his or her job performance.” Based on TRA, Davis et al. (1989) posited that perceived usefulness directly affects attitude toward using

the technology and behavioral intention to use it. This study proposes the following hypotheses.

Figure 1. The Proposed Model for OO technology and research hypothesis



H1a. Perceived usefulness of object-oriented programming has a direct effect on attitude toward using the technology.

H1b. Perceived usefulness of object-oriented programming has a direct effect on behavioral intention of using the technology.

H1c. Perceived usefulness of object-oriented programming has an indirect effect on behavioral intention through attitude toward using the technology.

Davis (1989) defined perceived ease of use as “the degree to which a person believes that using a particular system would be free of effort (p. 320).” In TAM, perceived ease of use was posited to directly affect perceived usefulness and attitude. In addition to the direct effect on attitude, perceived ease of use was considered to have an indirect effect on attitude through perceived usefulness. Mathieson (1991) and Szajna (1996) showed that ease of use is a significant predictor of usefulness. Davis (1989), Davis et al. (1989), and Mathieson (1991) reported significant relationships between attitude and ease of use. Therefore, the following hypotheses are proposed.

H2a. Perceived ease of use of object-oriented programming has a direct effect on perceived usefulness of the technology.

H2b. Perceived ease of use of object-oriented programming has a direct effect on attitude toward using the technology.

H2c. Perceived ease of use of object-oriented programming has an indirect effect on attitude through perceived usefulness.

Building on the work of Igarria (1993), attitudes toward using object-oriented programming refer to an individual's reaction to, evaluation of, and favorableness toward using the technology. In TRA, attitude was positioned to mediate the belief systems to behavioral intention of a particular behavior and behavioral intention was to mediate attitude to actual usage. Following TRA, in TAM, attitude toward using a technology was hypothesized to mediate the usefulness and ease of use to behavioral intention, which was then hypothesized to mediate attitude to actual usage of a technology. Though Davis et al. (1989) reported that attitude partially mediated the causal linkages between beliefs and behavioral intentions, and other researchers (Adams et al., 1992; Szajna, 1996) excluded attitude and behavioral intention in their research, these constructs are posited to play key roles in both TRA and TAM. Therefore, this study proposes the following hypotheses.

H3a. Attitude toward using object-oriented programming has a direct effect on behavioral intention of using the technology.

H3b. Behavioral intention of using object-oriented programming has a direct effect on actual usage of the technology.

1.3 Exogenous Variables of PBC

TPB posits a direct effect of exogenous variables on behavioral intention and actual usage through PBC, while TAM posits the direct effect of those variables on two belief constructs. PBC refers to individual's perceptions of "the presence or absence of requisite resources and opportunities" (Ajzen & Madden, 1986) provided by both individuals and organizations. This linkage was successfully proved by Mathieson (1991) and Thompson et al. (1991). Following the idea of PBC in TPB, this study investigates the process and effect of external variables on acceptance and usage of OO technology.

Individual characteristics. Zmud (1979) proposed a theoretical model to examine the effect of individual differences on the success of an information system. Since that study was published, individual characteristics have been reported to play a key role in MIS success. Leonard-Barton and Deschamps (1988) reported that factors connecting individuals and an organization are important than the general personality types or demographic factors. In particular, these authors reported that personality difference (personal innovativeness) in the manners of facing change is a good predictor of successful technology implementation. When adopting a new technology, personality is expected to play an important role. A person with more innovative personality would be willing to try new things. Zmud (1984) found that innovativeness or receptivity toward change of an organization's members was an important determinant of innovation success. Following TPB's argument that individual factors affecting PBC have a direct relation with behavioral intention and actual usage, this study proposes the following hypotheses. Nevertheless, in an attempt to compare the two models, this study does not exclude the possibility of finding a relationship between the two belief constructs (perceived usefulness and ease of use) and personal innovativeness.

H4a. The more innovative a person is, the more likely he/she would intend to use object-

oriented programming.

H4b. The more innovative a person is, the easier he/she would be to use object-oriented programming.

Gist (1987) reported that user training plays an important role in increasing user confidence in the ability to learn and use computers. This finding is meaningful in that it supports the idea of PBC of TPB. Ajzen (1985) referred to internal factors such as information, skills, and abilities as sources of deciding the level of PBC, in which training has been used as a way to increase individual skills and abilities of corresponding works. Raymond (1990) argued that computer training is a significant predictor of personal computing acceptance. It was also found that training had a positive impact on technology acceptance (Amoroso & Cheney, 1991; Igbaria et al., 1995). In addition, user experience of computer technology was also found to have a positive effect on system usage (Delone, 1988; Fuerst and Cheney, 1982; Igbaria et al., 1995). TPB and these prior research findings make it plausible that the length of training and experience directly affect behavioral intention of using object-oriented programming and actual usage of the technology. Therefore, this study proposes the following hypotheses.

H5a. The longer the training period about object-oriented programming, the more likely an individual would have intention to use the technology.

H5b. The longer the training period about object-oriented programming, the easier it would be for an individual to use the technology.

H5c. The more experience one has with computer technology similar to object-oriented programming, the more likely he/she would have intention to use the technology.

H5d. The more experience one has with computer technology similar to object-oriented programming, the easier he/she would use the technology.

Organizational support. Former studies have recognized organizational support as one of the crucial factors affecting successful adoption of system (Fuerst and Cheney, 1982; Igbaria et al., 1995; Igbaria, 1993; Igbaria et al., 1997). This study identifies two broad areas of organizational support: (1) technical support, which includes getting access to technology champions inside the organization and the number of IS professionals in a working group; and (2) management support, which includes management encouragement and sufficient resource allocation. Igbaria et al. (1997) found that external computing support has a strong influence on personal computing acceptance; however, little research has been done with the effect on technology acceptance of internal technical support. Rothwell and Zegveld (1985) describe a product champion as a person who can contribute to an organization as a business innovator, technological gatekeeper, and problem solver. Likewise, technology champions in information systems must be information gatekeepers about new information technologies, problem solvers, and helpers. The IS professionals in a working group may affect other members' perceptions of using OO technology. Accordingly, this study proposes the following hypotheses.

H6a. The easier the accessibility to technology champions inside the organization, the more likely he/she is to have the intention to use object-oriented programming.

H6b. The easier the accessibility to technology champions inside the organization, the more likely he/she is to use object-oriented programming.

H7a. The greater the number of IS professionals in a working group, the more likely he/she is

to have the intention to use object-oriented programming.

H7b. The greater the number of IS professionals in a working group, the more likely he/she is to use object-oriented programming.

The effect of management support on system usage has been widely researched and strongly proved (Igbaria, 1994; Igbaria et al., 1995; Igbaria et al., 1997; Kwon and Zmud, 1987). In particular, management support is found to be associated with greater system usage and lack of management support is regarded as a major barrier to the utilization of computers (Fuerst and Cheney, 1982; Lucas, 1978). Reflecting the role and position of PBC in this research, this study proposes the following hypotheses.

H8a. The stronger the management support, the more likely he/she to have the intention to use object-oriented programming.

H8b. The stronger the management support, the more likely he/she to use object-oriented programming.

2. Methodology

2.1 Data Collection

Data were gathered from information technology professionals of the Data Processing Management Association (DPMA) in four mid-western states of the U.S.. Before the final questionnaires were distributed, phone calls were made to local presidents of DPMA to solicit their members' participation in this survey. Subsequently, lists of DPMA directories were obtained with their permission. Eight hundred fifty-four questionnaires were sent to the members of nine chapters across four mid-western states. One hundred twenty-seven subjects responded to the questionnaires (the response rate = 14.9%). A reason why the response rate was relatively low may be that use of object orientation technology was still relatively new to the DPMA members at the time of the study. After deleting respondents who did not answer questions completely, 109 subjects who had experience in using both the structured methods and object orientation were included in the study.

Eighty-eight cases were included in the final statistical analysis due to the listwise deletion of missing values. The average age of the subjects was 43.4 years. The gender distribution was: males - 78 percent; females - 22 percent. Most subjects had the job title of supervisor (42%), while remaining subjects' titles were distributed among technical and managerial jobs. The average job experience was 18 years, a relatively high level of IS experience.

2.2 Data Analysis

A covariance matrix was used as an input to the LISREL 8 program (Joreskog & Sorbom, 1993) to analyze the structural model of this research. The estimation method used for the current research is maximum likelihood (ML). The covariance matrices are presented in Table 1. Management support, usefulness, ease of use, attitude and intention were represented by the total scores on these scales.

Based on the Technology Acceptance Model (TAM), the original path model can be described as follows. The personal innovativeness, experience with the structured methods, management support, length of training period, accessibility to champions and the number of IS professionals in the organization are hypothesized to directly influence usefulness and the ease of use. The ease of use and usefulness are hypothesized to mediate the influence of all

exogenous variables but to affect the attitude and behavioral intention directly. In particular, usefulness is hypothesized to mediate the influence of the ease of use on attitude and behavioral intention. Finally, behavioral intention is hypothesized to affect the actual usage. The proposition of this model, based on TAM, is that all of the exogenous variables are hypothesized to affect the actual usage indirectly through the ease of use, usefulness, attitude, and intention.

Table 1. Covariance matrix

	usage	use.	ease.	atti.	int.	# pro.	train.	acce.	exp.	innov.	sup.
usage	1.77										
usefulness	1.75	14.95									
ease of use	1.62	9.13	10.16								
attitude	1.32	8.30	5.96	7.49							
behavioral intention	0.89	5.91	4.09	4.42	3.73						
# of professionals	-.24	-2.20	-1.90	-.70	-.69	3.21					
training	.90	.66	.96	.21	.20	.01	2.41				
accessibility to T.C.	.31	.58	.41	.67	.43	.27	.41	1.30			
experience	1.78	-5.92	-3.55	-3.81	-1.79	-.79	-1.48	.20	99.62		
innovativeness	1.10	.02	.05	.51	.29	-.41	.73	.06	3.93	9.31	
support	1.22	2.32	.65	1.19	.99	.35	.84	1.37	-1.68	.63	9.25

A new model, which can better explain the acceptance processes of the object-oriented programming, is proposed by incorporating individual, managerial, and organizational characteristics into the original TAM model and by changing the positions of these variables in accordance with the theory of planned behavior. In this proposed model, except for the perceived usefulness and ease of use of object-oriented programming, all the exogenous variables (the length of formal training, personal innovativeness, managerial support, number of professionals, accessibility to technology champion, and personal experience with previous technology) are hypothesized to affect both behavioral intention and actual usage of the object-oriented programming. These relationships are in accordance with the role of the perceived behavioral control (PCB) based on the theory of planned behavior. The usefulness and ease of use are hypothesized to affect the attitude toward object-oriented programming, and then the attitude and usefulness are hypothesized to affect behavioral intention. The actual usage of object-oriented programming is then affected by behavioral intention along with the perceived behavioral control variables. In the proposed research model, therefore, the usefulness and ease of use are shifted from endogenous variables to exogenous variables. Figure 1 concisely shows the relationships among the research variables in the proposed model.

3. Results

An initial test of the proposed model and TAM model showed several paths with non-significant t-values. These paths were deleted one at a time and each time the model was re-estimated. The standardized path coefficients based on the initially proposed model are presented in Table 2 and Figure 2. The final model was obtained by deleting all paths with non-significant t-values as shown in Figure 3.

As expected, relationships of core variables of the original TAM model are strongly supported in the case of object-oriented programming acceptance. Perceived usefulness of object-oriented programming has a direct effect on attitude and direct and indirect effect on behavioral intention of using the technology (Path coefficients: H1a = .44, H1b = .18;

Probabilities: <.01; Indirect effect for H1c = .18). The perceived ease of use of object-oriented programming has a direct effect on perceived usefulness of the technology and direct and indirect effect on attitude through perceived usefulness of object-oriented programming (Path coefficients: H2a = .90, H2b = .19 ; Probabilities: <.01; Indirect effect for H2c = .40). It is proved that attitude toward using object-oriented programming has a direct effect on behavioral intention and that behavioral intention of using object-oriented programming has a direct effect on actual usage of the technology (Path coefficients: H3a = .40, H3b = .21; Probabilities: <.01).

Table 2. Standardized path coefficients for the initially proposed model

Parameter	Standardized Path Coefficient
ease of use to usefulness	.90**
usefulness to attitude	.44**
ease of use to attitude	.19**
attitude to intention	.39**
usefulness to intention	.18**
training to intention	-.0058
innovativeness to intention	.0048
support to intention	.0088
# of professionals to intention	-.011
accessibility to T.C. to intention	.039
experience to intention	.0072
intention to usage	.20**
training to usage	.32**
innovativeness to usage	.069
support to usage	.084*
# of professionals to usage	-.024
accessibility to usage	-.019
experience to usage	.025**

** < .01

* < .05

Table 3. Decomposition of the effects using the final model

Direction	Effects		
On usefulness	Direct	Indirect	Total
of ease of use	.90		.90
On attitude			
of usefulness	.44		.44
of ease of use	.19	.40	.59
On Intention			
of attitude	.40		.40
of usefulness	.18	.18	.36
On Usage			
of intention	.21		.21
of innov			
of training	.34		.34
of experience	.03		.03
of support	.08		.08
of attitude		.08	.08
of usefulness		.08	.08
of ease of use		.02	.02

Figure 2. Standardized path coefficients for the initially proposed model

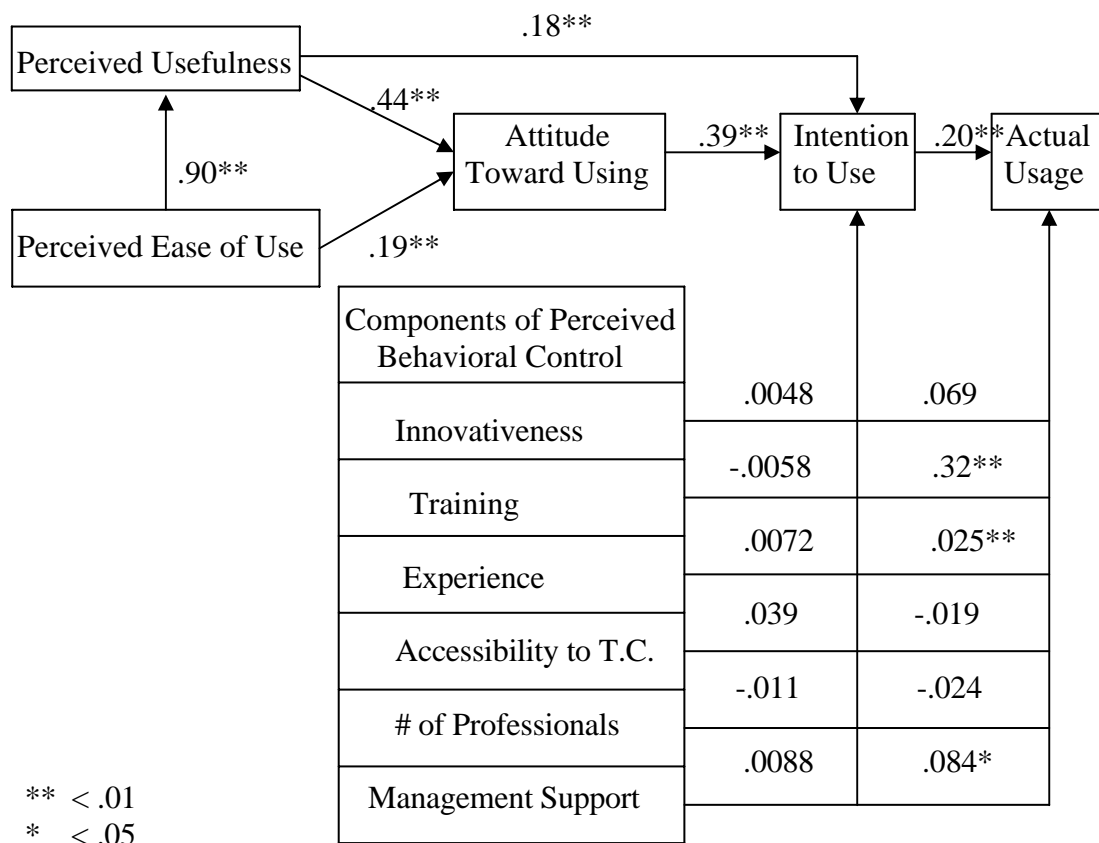
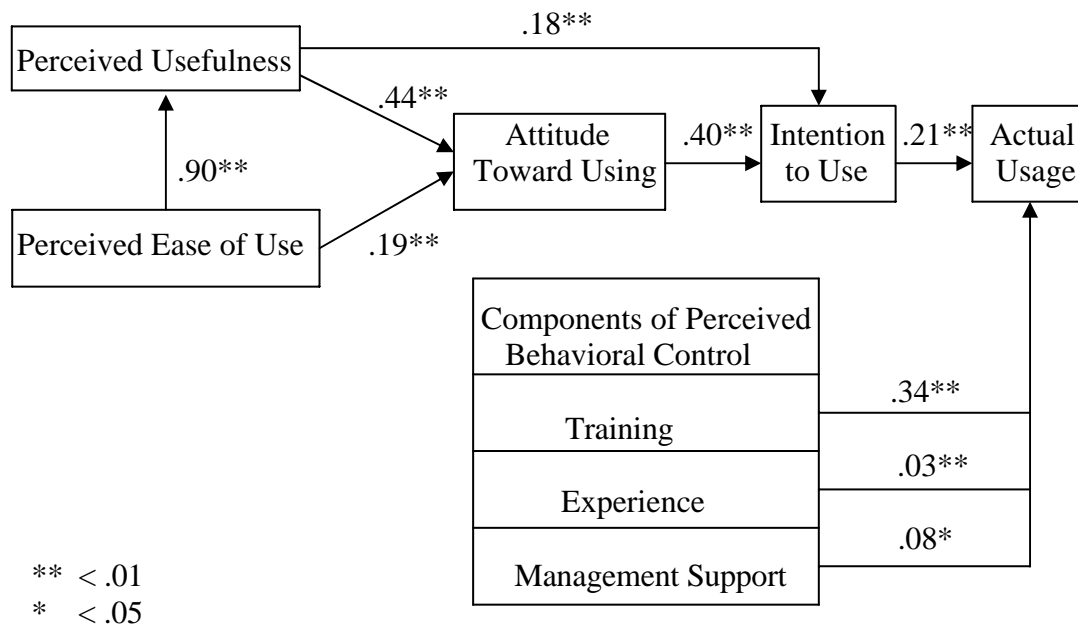


Figure 3. Standardized path coefficients for the final model



From Figure 3, the perceived behavioral control variables such as training, experience with related technology, and management support are shown to influence actual usage directly without being mediated by other variables (Path coefficients: H5b = .34; H5d = .03; H8b = .08; Probabilities: <.01, <.05 (H8b)). Other perceived behavioral control variables such as the

number of professionals and accessibility to technology champions do not significantly influence both behavioral intention and actual usage.

Contrary to expectations, the length of training period, experience, and managerial support do not have significant relationships with behavioral intention. The number of professionals, accessibility to technology champions, and personal innovativeness do not affect both behavioral intention and actual usage.

Table 3 shows that decomposition of the effects of exogenous variables on actual usage confirms the previous results. This table manifests that there are only direct effects on actual usage of behavioral intention, experience, length of training period, and management support, whereas the remaining variables have indirect effects on the actual usage.

The values of several goodness of fit indices for the original TAM and the proposed model are shown in Table 4. Bentler and Bonnett (1980) suggested NFI (Normed Fit Index) that could be interpreted as an improvement in the fit of the hypothesized model over a baseline model. Because a better model-fit can always be obtained by adding parameters to the model, James, Mulaik, and Brett (1982) have proposed PNFI (Parsimonious Normed Fit Index) that gains the improvement in the model fit at the expense of degrees of freedom. In addition to these, the conventional chi-square statistic is reported for testing the goodness of fit of the models in this research. Except for the chi-square value, larger values are desirable for NFI and PNFI. In addition, a single sample cross-validation index (ECVI) is used (Browne & Cudeck, 1989).

As can be seen in Table 4, compared to the original TAM model, the proposed model in this research is interpreted as having a better model fit. The proposed model (model 3) has significantly better fit than the original TAM model (model 1). The comparison between two trimmed models tells that the finally trimmed model (model 4) has significantly better fit than the TAM model (model 2). The model comparison index in Table 5, based on the chi-square difference test between the proposed model and the original TAM model, confirms that the proposed model has significantly improved over the original TAM model. In conclusion, it is clearly evident that the proposed model presented in this paper is an improvement over the original TAM model not only in explaining the effects of exogenous variables on technology adoption but also in interpreting their relationships.

Table 4. Goodness of fit indices for the TAM and proposed models

Model	Chi-Square	df	Prob.	NFI	PNFI	ECVI
TAM model (model 1)	49.07	22	<.01	.87	.35	1.71
Trimmed TAM(model 2)	35.44	16	<.01	.90	.51	.91
Proposed model(model 3)	24.45	16	.08	.94	.27	1.58
Final model (model 4)	13.50	13	.41	.96	.45	.73

Table 5. Model comparisons with chi-square difference test

Comparisons	Chi-square	df
Model 1 to Model 3	24.62**	6
Model 2 to Model 4	21.94**	3

** < .01

4. Discussion and Conclusion

This research has replicated most of previous research's findings. In line with the findings by Davis (1989), usefulness and the ease of use of object-oriented programming are found to influence the actual usage of this technology through attitude and behavioral intention. While this research includes the concept of the planned behavior (Ajzen, 1991), the main idea of TAM is also confirmed.

This study investigated the difference between the TAM and a proposed model. According to the results of goodness of fit indices, the proposed model is superior to TAM. The main difference between these two models is the position of exogenous variables. In the proposed model, usefulness and the ease of use variables are shifted from endogenous variables as in TAM to exogenous variables. In addition, individual, managerial, and organizational variables, which are located ahead of usefulness and the ease of use in the original TAM, are shifted to precede behavioral intention and actual usage (see Figure 1).

The comparison of these two models through the goodness of fit indices demonstrates that the proposed model shows better model fit than TAM. These results are very encouraging in that the proposed model showed a potential role of perceived behavioral control for adoption of new technologies. According to TAM, which does not include the concept of perceived behavioral control, every exogenous variable (individual, managerial, and organizational) is assumed to directly influence the usefulness and ease of use of a new technology. With the concept of perceived behavioral control, this research found that it would be better to directly relate these exogenous variables to behavioral intention and actual usage rather than to relate these variables to usefulness and the ease of use. Though Venkatesh and Davis (2000) suggest the extended TAM by introducing the subjective norm concept into TAM, this research incorporates the concept of perceived behavioral control into the TAM in order to advance technology acceptance theory.

With regard to the effects of research variables on technology adoption, most of the results of this study are in line with those of the previous research. Individual experience (Hill et al., 1987), management support (Leonard-Barton & Deschamps, 1988), and the length of training period (Alexander, 1989) were shown to critically influence the adoption of OO technology. Contrary to the previous research, the other variables such as the accessibility to technology champions (Alexander, 1989) and the number of IS professionals in the organization (Zmud, 1984) were not shown to significantly influence the adoption of OO technology. These unexpected results might be derived from two possibilities. First, this study had a relatively small sample size, and it might have produced biased statistical results. Second, the multicollinearity among the research variables might have caused this result.

Even though TAM has been widely used for studying the adoption process of new technologies, TAM seems to overemphasize the technology-related variables such as usefulness and the ease of use. This research attempted to overcome the limitations of TAM by incorporating the concept of perceived behavioral control.

The current research has some limitations. First, compared to the number of estimated parameters, the sample size is somewhat small. Bentler and Chou (1987) recommended that the ratio of the sample size to the number of free parameters be at least 10:1. In light of this criterion, this research could have produced some unstable estimation of parameters. For small sample sizes, ML (Maximum Likelihood) or GLS (Generalized Least Squares) estimates would be helpful, and the parameter estimates of this study might not be too much

out of line. Second, some of the measurement items used for this study do not show univariate normal distribution measured by kurtosis and skewness criteria. This problem could have exaggerated the chi-square value and lowered SEs and parameter estimates. But in the sense that most items have an appropriate normal distribution, it could be said that this problem should not seriously affect this research. Third, the sample was collected from the mid-west area of the U.S., and the data might be a little out of date. This fact might limit the external validity of this research.

This study mainly focused on the role of perceived behavioral control variables in relation to their affecting OO technology acceptance, which is theorized based on TPB. Important is the finding that these variables directly affect OO technology acceptance without being mediated by perceptual variables such as the perceived usefulness and the ease of use of the technology, which was proposed by the original TAM. However, the detailed mechanism is not revealed of how these PBC variables affect acceptance of OO technology. Future research is required to investigate this area and to provide a strong theoretical foundation for another robust technology acceptance model.

References

- Adams, D. A., R. R. Nelson, and P. A. Todd (1992), "Perceived Usefulness, Ease of Use, and Usage of Information Technology: A Replication," *MIS Quarterly*, 16(2), 227-247.
- Ajzen, I. (1985), From Intentions to Actions: A Theory of Planned Behavior. In J. Kuhl and J. Beckmann (Eds.), *Action-Control: From Cognition to Behavior* (11-39). Heidelberg: Springer.
- Ajzen, I. (1991), "The Theory of Planned Behavior," *Organizational Behavior and Human Decision Processes*, 50, 179-211.
- Ajzen, I. and T. Madden (1986), "Prediction of Goal-Directed Behavior: Attitudes, Intentions, and Perceived Behavioral Control," *Journal of Experimental Social Psychology*, 22, 453-474.
- Alexander, M. B. (1989), "The Adoption and Implementation of Computer Technology in Organizations: The Example of Database Machines," *Unpublished Doctoral Dissertation*, Indiana University.
- Amoroso, D. L. and P. H. Cheney (1991), "Testing a Causal Model of End-User Application Effectiveness," *Journal of Management Information Systems*, 8(1), 63-89.
- Bayer, J. and N. Melone (1989), "A Critique of Diffusion Theory as a Managerial Framework for Understanding Adoption of Software Engineering Innovations," *The Journal of Systems and Software*, 9, 161-166.
- Bentler, P. M. and D. G. Bonett (1980), "Significance Tests and Goodness of Fit in the Analysis of Covariance Structures," *Psychological Bulletin*. 88, 588-606.
- Bentler, P. M. and C. Chou (1987), "Practical Issues in Structural Modeling," *Sociological Methods & Research*, 16, 78-117.
- Browne, M. W. and R. Cudeck (1989), "Single Sample Cross-Validation Indices for Covariance Structures," *Multivariate Behavioral Research*, 24, 445-455.
- Chang, H., J. Kim, and C. Oh (2002), "Technology Acceptance Model with Web Interactivity," *The Journal of MIS Research*, 12(4), 55-75.
- Chau, P. and P.J. HU(2002), "Examining a Model of Information Technology Acceptance by Individual Professionals: An Exploratory Study," *Journal of Management Information Systems*, 18(4), 191-229.
- Chen, L., M.L. Gillenson, and D.L. Sherrell (2002), "Enticing Online Consumers: An Extended Technology Acceptance Perspective," *Information & Management* 39(8), 705-719.

- Coleman, J. S. (1986), "Social Theory, Social Research, and a Theory of Action," *American Journal of Sociology*, 91, 1309-1335.
- Davis, F. D. (1986), "A Technology Acceptance Model for Empirically Testing New End User Information Systems: Theory and Results," *Doctoral Dissertation*, Sloan School of Management, MIT.
- Davis, F. D. (1989), "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, 13(3), 319-339.
- Davis, F. D., R. P. Bagozzi, and P. R. Warshaw (1989), "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science*, 35(8), 982-1003.
- DeLone, W. H. (1988), "Determinants of Success for Computer Usage in Small Business," *MIS Quarterly*, 12(1), 51-61.
- Detienne, F. (1995), "Design Strategies and Knowledge in Object-Oriented Programming Effects of Experience," *Human-Computer Interaction*, 10, 129-169.
- Detienne, F. and R. Rist (1995), "Introduction of this Special Issue on Empirical Studies of Object-Oriented Design," *Human-Computer Interaction*, 10, 121-128.
- Fishbein, M. and I. Ajzen (1975), *Belief, Attitude, Intentions and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.
- Fuerst, W. and P. Cheney (1982), "Factors Affecting the Perceived Utilization of Computer-Based Decision Support Systems in the Oil Industry," *Decision Sciences*, 13(4), 554-569.
- Gist, M. E. (1987), "Self-Efficacy: Implications for Organizational Behavior and Human Resource Management," *Academy of Management Review*, 12, 472-485.
- Hill, T., N. D. Smith, and M. F. Mann (1987), "Role of Efficacy Expectations in Predicting the Decision to Use Advanced Technologies: The Case of Computers," *Journal of Applied Psychology*, 72(2), 307-313.
- Igbaria, M. (1993), "User Acceptance of Microcomputer Technology: An Empirical Test," *Omega*, 21(1), 73-90.
- Igbaria, M. (1994), "An Examination of the Factors Contributing to Technology Acceptance," *Accounting, Management and Information Technologies*, 4(4), 205-224.
- Igbaria, M., T. Guimaraes, and G. B. Davis (1995), "Testing the Determinants of Microcomputer Usage via a Structural Equation Model," *Journal of Management Information Systems*, 11(4), 87-114.
- Igbaria, M., N. Zinatelli, P. Cragg, and A. L. M. Cavaye (1997), "Personal Computing Acceptance Factors in Small Firms: A Structural Equation Model," *MIS Quarterly*, 21(3), 279-305.
- James, L. R., S. A. Mulaik, and J. M. Brett (1982), *Causal Analysis, Assumptions, Models, and Data*. Beverly Hills, CA: Sage.
- Jiang, J.J., W.A. Muhanna, and G. Klein (2000), "User Resistance and Strategies for Promoting Acceptance across System Types," *Information & Management* 37(1), 25-36.
- Joreskog, K.G. and D. Sorbom (1993), *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*. Chicago: Scientific Software International.
- Kim, I. (2000), "A Study of the Technology Acceptance of Object-Oriented Computing: The Case of Technology Acceptance Model," *The Journal of MIS Research*, 12(3), 1-22.
- Kwon, T.H. and R. W. Zmud (1987), *Unifying the Fragmented Models of Information Systems Implementation*. New York: John Wiley & Sons.
- Lee, C. S. and S. Y. Jang (2003), "User's Acceptance of Information Systems in Extended Technology Acceptance Model," *Korean Management Review*, 32(5), 1415-1451.
- Lee, K. C., N. H. Chung, and J. S. Lee (2002), "Empirical Study about Relationship between Factors Influencing Korean User's Intention to Use the Internet Banking Service," *The Journal of MIS Research*, 12(3), 191-212.

- Legris, P., J. Ingham, and P. Colletrette (2003), "Why Do People Use Information Technology? A Critical Review of the Technology Acceptance Model," *Information and Management*, 40, 191-204.
- Leonard-Barton, D. (1987), "Implementing Structured Software Methodologies: A Case of Innovation in Process Technology," *Interfaces*, 17(3), 6-17.
- Leonard-Barton, D. and I. Deschamps (1988), "Managerial Influence in the Implementation of New Technology," *Management Science*, 34, 1252-1265.
- Lucas, H.C. (1978), "Empirical Evidence for a Descriptive Model of Implementation," *MIS Quarterly*, 2(2), 27-41.
- Mathieson, K.(1991), "Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior," *Information Systems Research*, 2(3), 173-191.
- Montazemi, A. R. (1988), "Factors Affecting Information Satisfaction in the Context of the Small Business Environment," *MIS Quarterly*, 12(2), 239-256.
- Moon, J. and Kim, Y. (2001) "Extending the TAM for a World-Wide-Web context," *Information & Management*, 38(4), 217-230.
- Pennington, N., A. Y. Lee, and B. Rehder (1995), "Cognitive Activities and Levels of Abstraction in Procedural and Object-Oriented Design," *Human-Computer Interaction*, 10, 171-226.
- Purao, S., H.K. Jain, D.L. Nazareth (2001), "An Approach to Distribution of Object-Oriented Applications in Loosely Coupled Networks," *Journal of Management Information Systems* 18(3), 195-234.
- Raymond, L. (1985), "Organizational Characteristics and MIS Success in the Context of Small Business," *MIS Quarterly*, 9(1), 37-52.
- Raymond, L. (1990), "End-User Computing in the Small Business Context: Foundations and Directions for Research," *Database*, 20(4), 20-26.
- Rogers, E. M. (1983), *Diffusion of Innovation*. New York: The Free Press.
- Rothwell, R. and W. Zegveld (1985), *Reindustrialization and Technology*. Armonk, NY: Sharpe Inc.
- Straub, D., M. Limayem, and E. Karahanna Evatisto (1995), "Measuring System Usage: Implications for IS Theory Testing," *Management Science*, 41(8), 1328-1342.
- Son, D. H. (2001), "The Role of Psychological Factors Towards the TAM Model," *Journal of the Korean Operations Research and Management Science Society*, 26(1), 1-14.
- Szajna, B. (1996), "Empirical Evaluation of the Revised Technology Acceptance Model," *Management Science*, 42(1), 85-92.
- Taylor, S. and P. A. Todd (1995), "Understanding Information Technology Usage: A Test of Competing Models," *Information Systems Research*, 6(2), 144-146.
- Thompson, R. L., C. A. Higgins, and J. M. Howell (1991), "Personal Computing: Towards a Conceptual Model of Utilization," *MIS Quarterly*, 15(1), 125-143.
- Venkatesh, V. (1999), "Creation of Favorable User Perceptions: Exploring the Role of Intrinsic Motivation," *MIS Quarterly*, 23(2), 239-260.
- Venkatesh, V. and F. D. Davis (1996), "A Model of the Antecedents of Perceived Ease of Use: Development and Test," *Decision Sciences*, 27(3), 451-481.
- Venkatesh, V. and F. D. Davis (2000), "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies," *Management Science*, 46(2), 186-204.
- Venkatesh, V., M.G. Morris, G.B. Davis, and F.D. Davis (2003), "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly*, 27(3), 425-478.
- Yap, C. S., P. P. Soh, and K. S. Raman (1992), "Information Systems Success Factors in Small Business," *Omega*, 20(5/6), 597-609.

- Zmud, R.W. (1979), "Individual Differences and MIS Success: A Review of the Empirical Literature," *Management Science*, 25(10), 960-978.
- Zmud, R.W. (1984), "An Examination of Push-Pull Theory Applied to Process Innovation in Knowledge Work," *Management Science*, 30(6), 727-738.