View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by AIS Electronic Library (AISeL)

Association for Information Systems

AIS Electronic Library (AISeL)

ICIS 2003 Proceedings

International Conference on Information Systems (ICIS)

December 2003

A Model of Group Technology Acceptance: Some Preliminary Findings

Saonee Sarker
Washington State University

Suprateek Sarker
Washington State University

Follow this and additional works at: http://aisel.aisnet.org/icis2003

Recommended Citation

Sarker, Saonee and Sarker, Suprateek, "A Model of Group Technology Acceptance: Some Preliminary Findings" (2003). *ICIS 2003 Proceedings*. 69.
http://aisel.aisnet.org/icis2003/69

This material is brought to you by the International Conference on Information Systems (ICIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in ICIS 2003 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

A MODEL OF GROUP TECHNOLOGY ACCEPTANCE: SOME PRELIMINARY FINDINGS

Saonee Sarker and Suprateek Sarker
School of Accounting, Information Systems, and Business Law
College of Business and Economics
Washington State University
Pullman, WA USA
ssarker@wsu.edu **sarkers@cbe.wsu.edu**

Abstract

While the literature on the technology acceptance model and its extensions have contributed significantly to our understanding of how individuals *accept a technology, little is known about how groups accept technology. Since organizations are moving to collective structures such as groups that are provided with technologies for performing tasks, it is critical to understand how they accept and use technology so as to better guide organizations' investments and implementation decisions. Drawing on theories of group influence, and prior research on group communication media and conflict, the paper proposes an input-process-output (I-P-O) model for conceptualizing group technology acceptance. We also present some preliminary empirical results that appear to support key aspects of the model.*

Keywords: Group technology acceptance, valence, input-process-output model, group process, communication

Introduction

Failure to adopt and routinize new technologies is one of the primary causes for the lack of returns on IT investments in organizations (Davis et al. 1989, Lucas and Spitler 1999; Venkatesh and Davis 2000). In order to provide IT researchers and practitioners with an understanding of why users accept or reject the technologies, Davis et al. (1989, p. 982) proposed and empirically tested the widely known technology acceptance model (TAM).

Following the study by Davis et al., a stream of research has been conducted on TAM, focusing on factors that explain an individual's use of a technology. Most of these studies have focused on validating TAM in different technology contexts (e.g., Lucas and Spitler 1999; Karahanna and Straub 1999), examining different antecedents of the perceptions of ease of use, the usefulness of the technology (the two main variables in TAM), and the intentions to use the technology (e.g., Agarwal and Prasad 1999; Gefen and Keil 1998; Venkatesh and Davis 1996, 2000; Venkatesh and Morris 2000), and comparing TAM with other models of technology adoption (e.g., Plouffe et al. 2001; Taylor and Todd 1995). Undoubtedly, the prior research studies have contributed significantly to the state of knowledge on technology acceptance, although the focus has predominantly been on individuals.

However, today, organizations are increasingly moving to structures where a substantial proportion of tasks are being performed by groups, rather than by individuals (Jehn and Mannix 2001). These groups are often provided with technologies for increasing the efficiency of their task performance (Ramarupa et al. 1999). Unfortunately, no known research has provided us with an understanding of the factors that influence a *group's* adoption of a technology. Theoretical models pertaining to individual acceptance cannot be automatically applied to group acceptance since a collective adoption is not only affected by the individual members' attitudes related to the technology but also by the social and relational interaction patterns among them (McGrath 1984). Thus we argue that current research on technology adoption falls short of explaining how the members (collectively as a group) accept or reject a particular technology. In an effort to fill this void, this research study seeks to develop and test a model of *group* *technology acceptance.*[1] Literature suggests that no group activity is free from issues related to the group's dynamics, particularly the internal influence processes (e.g., Meyers and Brashers 1999). Thus, in developing our model, we draw upon the literature on group influence processes (specifically, the research on *valence* from the communication literature), in addition to the existing research on technology adoption. Further, recognizing that whenever there is interaction between two or more people in a social system (such as a group), there is potential for conflict (Fisher and Ellis 1990), we have incorporated conflict into our model. Finally, given that contemporary organizational groups may be face-to-face (FTF) or computer-mediated (CMC), the role of the communication media on group technology acceptance is also examined.

Developing a New Model of Group Technology Acceptance

Shaw (1981, p. 8) defines groups as "two or more persons who are interacting with one another in such a manner that each person influences and is influenced by each other person." In theorizing about group technology acceptance, following McGrath's (1984) suggestion, we use the input-process-output (I-P-O) model as our organizing framework. In our I-P-O model of group technology acceptance,[2] we examine the effect of members' prior attitudes about the technology and the communication media used by the group as key *inputs*, the majority opinion in the group, intra-group conflict, group valence, and the group's adoption behavior as *process* variables, and process satisfaction, solution satisfaction, and solution quality as the key *output* variables (see Figure 1).

In understanding the role of the members' pre-group interaction attitudes and the influence of the majority members on the process of technology acceptance, a family of contemporary theories on valence is drawn upon, which seek to explain how groups adopt a decision from a set of options. *Valence* is defined as the degree of positive or negative feeling against or for a certain option. The notion of valence has been studied at three different levels (Meyers and Brashers 1999), with different theoretical perspectives pertaining to each of the levels: the social comparison theory for individuals (Sanders and Baron 1977), the distributive valence model for subgroups (McPhee et al. 1982), and the group valence model for groups (Hoffman and Kleinman 1994).

According to valence theorists focusing at the group level, the strongest indicator of a group's adoption of a certain choice is the group's valence (Hoffman and Kleinman 1994). Drawing on this perspective, it could be argued that the strongest indicator of a group's adoption of a technology will be the group's valence toward this technology. Consequently, group valence takes on a central position in our model. Next, we examine how different factors such as the individual members' attitudes affect group valence and the group's adoption of the technology.

Input Hypotheses

The social comparison theory (SCT) holds that prior to any intra-group interactional exchanges, group-members have an initial preference/attitude, which has a significant effect on the group interaction (Sanders and Baron 1977). In the context of the technology acceptance, members' initial attitudes toward the technology can be expected to play a role, especially in determining the group's valence toward the technology. During the group interaction process, members compare their own *a priori* attitudes toward the technology with others' attitudes, thereby creating social influence among group members. This contributes to the formation of a group-level valence (Sanders and Baron 1977).

> *H1: Group members' attitudes toward the technology prior to the group interaction will have a significant effect on the group's valence toward the technology.*

The nature of influence of the group members' initial attitudes on the group's valence may be affected by the communication medium (Zigurs et al. 1988). Prior research argues that a CMC channel may lower the level of status influences, and provide "continuous airtime to each group member" (Zigurs et al. 1988, p. 629), leading to a more egalitarian influence in such groups (Mennecke and Valacich 1988). Thus we argue

> *H2: Group members' attitudes toward a technology will have different effects in CMC and FTF groups.*

---

[1]Consistent with the TAM literature, we use the words acceptance and adoption interchangeably.

[2]The literature suggests that there are many types of groups, and a single theoretical model may not applicable to all types. The model proposed and tested here was developed primarily for groups termed as *task forces* by McGrath (1984), which are put together to perform a certain task and are disbanded once the task is completed.

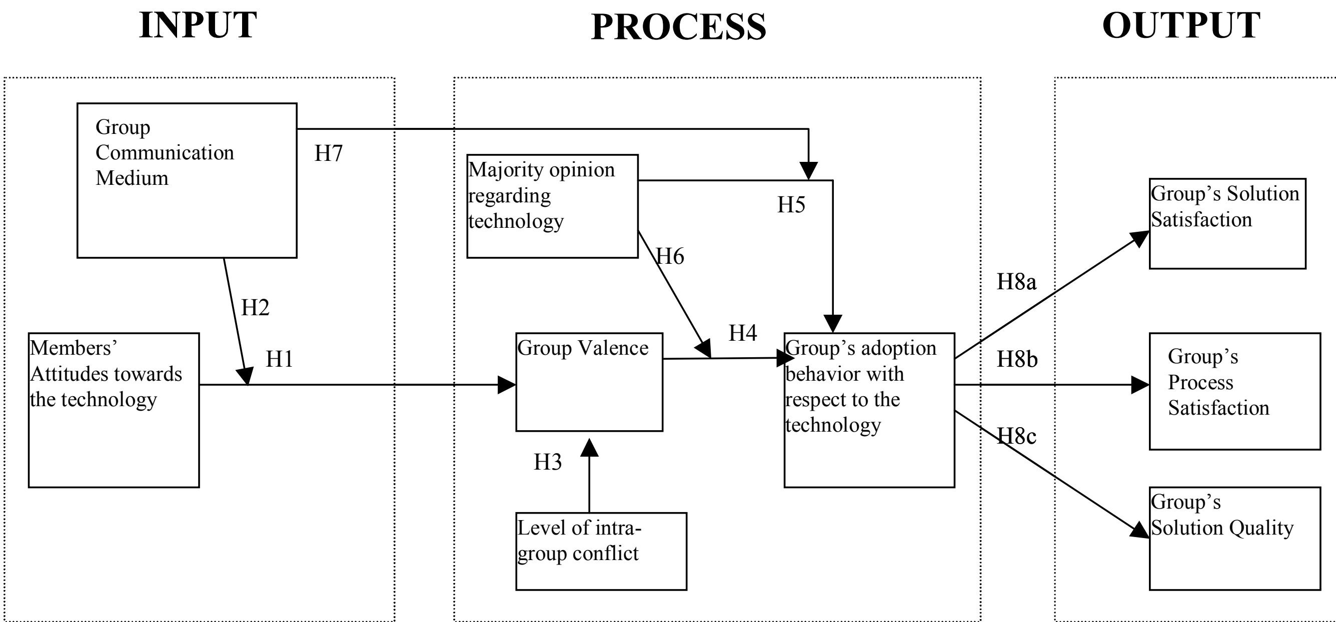

Figure 1. Group Technology Acceptance Model (GTAM)

Process Hypotheses

One of the major components of a group interaction process is the level of intra-group conflict. Of the many types of conflict, issue-based conflict is most closely associated with interactions in groups without history and of limited temporal scope, and is often reflected in animated discussions about ideas and differences in opinion about issues that are important to the group (Jehn and Mannix 2001). Interestingly, issue-based conflict has been found to have positive group effects (e.g., Jehn and Chatman 2001). Thus, it is argued that groups involved in the process of making a judgment regarding the adoption of a technology are likely to have a positive orientation (i.e., valence) toward its acceptance when issue-based conflict exists.

H3: Existence of high level of issue-based conflict among members will lead to a positive group valence.

Proponents of the GVM have attempted to predict group behaviors from the group's valence. Hoffman and Kleinman (1994) suggest that the greater the group valence toward an alternative, the more likely that the alternative will be adopted. This means that during a group's technology acceptance process, the technology that is viewed positively (i.e., has a high group valence), will be adopted by the group.

H4: Group's valence will have a significant positive effect on the group's level of technology adoption.

While the group valence model claims that a group's valence is the primary indicator of its adoption of a choice option, the distributed valence model, on the other hand, suggests that the opinion of the largest or most powerful subgroup results in the greatest influence on the group. The group adoption, according to this theoretical perspective, is a function of the *pattern of support among members*. The majority rule under this theory states that the valence of the subgroup with the majority of members tends to influence the group's choice behavior (i.e., adoption in this context).

H5: Majority opinion regarding a technology will have a direct positive effect on the group's level of technology adoption.

Many researchers have argued for the coexistence of both GVM and DVM in creating an understanding of the group interaction process (Hoffman and Kleinman 1994). Proponents of the DVM (McPhee et al. 1982), for example, argue that the valence of the majority not only directly affects the adoption behavior of the group (as in hypothesis 5), but also influences the effect of the group's valence. In other words, valence researchers contend that a majority preference for a certain solution helps to move the group's orientation toward the adoption of the subgroup's preferred solution (McPhee et al. 1982).

H6: The majority's opinion regarding the technology will positively moderate the effect of the group valence on the group's level of technology adoption.

Finally, drawing on studies which suggest that the absence of visual and verbal cues in a computer-mediated environment lowers the ability of the majority to influence the group and also enables the minority to challenge the majority thinking (Tan et al. 1998), we argue

H7: The effect of the majority's opinion regarding a technology will be lower in CMC groups than in FTF groups.

Output Hypotheses

The resource utilization theory (Zigurs et al. 1991) argues that technology is a resource, and higher use of it (i.e., higher degree of adoption of technology) can have significant effects on the satisfaction of the users.

H8a: Higher level of technology adoption will lead to higher solution satisfaction of group members.

H8b: Higher level of technology adoption will lead to higher process satisfaction of group members.

Technology adoption has often been associated with improved individual as well as group outcomes (Lucas and Spitler 1999). It follows that when groups use a certain technology to perform a task, the quality of the solution generated from the group task performance process should be higher than the solutions generated by groups that do not use the technology (McGrath 1984; Wheeler and Valacich 1996; Zigurs et al. 1991).

H8c: Higher level of technology adoption will lead to better group solutions.

Research Methodology

Sample, Task, Technology Use, and Training

In order to pilot test the model proposed here, a laboratory experiment involving 52 student groups (with an useable sample size of 48) was conducted. Each group (consisting of three members) was assigned a Type 3 intellective task (McGrath 1984), wherein they were required to create an entity-relationship (E-R) diagram for a problem drawn from Ryan et al. (2000), using one of the two following technologies: the drawing tool of MS Word and Visible Analyst 7.5 (a CASE tool) (i.e., the groups had to collectively make a decision to adopt one of the technologies). Prior to the experiment, a 75-minute training was provided to each participant using both MS Word and Visible Analyst 7.5 to create E-R diagrams. During the training sessions, E-R diagramming concepts were also reviewed.[3]

Computer-mediated groups communicated only through the use of MS NetMeeting. Participants in the CMC groups were provided training in NetMeeting. A post-training questionnaire showed that the participants' level of comfort and familiarity with the tool was 4.21 on a scale of 1 (low) to 5 (high).

[3]All participants were already familiar with E-R concepts, since they were junior or senior level undergraduate students majoring in information systems and enrolled in a database course or a systems analysis and design course.

Measures

Many of the constructs in our model such as individual members' pre-interaction attitudes, group's satisfaction with the process, and solution were measured using established instruments that have been validated in prior studies, while for constructs such as group valence, and group's adoption behavior, new instruments were developed (see Table 1).

A key issue in the measurement of GTAM constructs is choosing an appropriate level of analysis. Zigurs (1993) argues that the common practice of collecting individual-level data and aggregating them across groups to receive group-level data is inherently problematic. Following the recommendations of prominent researchers such as McGrath and Hollingshead (1993), critical variables such as the group valence and group's adoption behavior were measured at the group level (and not at an individual level).

Table 1. Measuring for the GTAM Model

Specific variable in GTAM	Suggested Measure	Reliabilities
Inputs		
Members' pre-group interaction attitudes	Four item scale of individual attitudes from Davis et al. (1989), administered to individual group members, and average of scores taken as the input	.81
Process		
Group Valence	New items measuring the group's positive orientation and feeling towards the technology	.87
Group's adoption behavior with respect to technology	Items measuring *group's* intention to use, prediction of use, and extent to which they have used (some drawn from Davis et al. 1989) and adapted to a group level	.93
Majority valence	Binary measure that captured whether or not the majority's choice of tool was same as that of the group	
Intra-group conflict (issue-based)	Issue-based conflict scale from Miranda and Bostrom (1991)	.85
Outcomes		
Solution Quality	Rating of solution generated by the group by independent raters	.97
Process Satisfaction	Modified version of Green and Taber's (1980) scale	.88
Solution Satisfaction	Modified version of Green and Taber's (1980) scale	.80

Instrument Validation, Model Testing, and Results So Far

In validating our instruments, we followed standard guidelines (e.g., Churchill 1979), which included specification of the domain of constructs, generation of the sample of items, collection of data, purification of the measures (calculation of the reliabilities), and assessment of the convergent validity using SEM (for the group valence, group's use of the technology, process satisfaction, and solution satisfaction constructs). Tables 1 and 2 show the reliabilities of each construct and the SEM results.

Linear regression was conducted to test the hypotheses. All assumptions of the regression were tested. In addition, the variance inflation factor (VIF) and the condition index were examined for multicollinearity effects. Finally, structural equation modeling was used to test the fit of the model to data. The results are summarized in Table 3. Most of the hypotheses (except for the effect of the communication media on majority influence and the role of conflict) were supported. Some hypotheses (e.g., 5, 8a, and 8b) were supported at $p< .10$, which is not surprising given the small sample size. Testing of the overall model using SEM, yielded the following results: χ^2 (10, $p> .10$) = 14.94; GFI= .91; NFI= .76; IFI= .91; CFI= .90; RMSEA= .10 (quite acceptable given that the number of variables to data point ratio was relatively high).

Table 2. Results of CFA

CFA of the group valence and the group use constructs yielded the following results: $\chi^2(19, p > .10) = 18.64$; GFI = .91; NFI = .95; IFI = 1.00; CFI = 1.00; RMSEA= .00, Std. Factor Loadings = .59-.98
CFA of the process and solution satisfaction constructs yielded the following results: $\chi^2 (33, p < .05) = 52.18$; GFI = .94; NFI = .93; IFI = .97; CFI = .98; RMSEA= .061, Std. Factor Loadings = .36-.88

Table 3. Summary of Preliminary Results

H#	Dependent Variable	Nature of Prediction	Coefficient (Standard Error)	Nature of Hypothesis Support
H1	Group Valence	Group Members' Attitude will have a positive effect on DV	.485*** (.195)	Yes
H2	Group Valence	Effect of Group Members' Attitudes on DV will be different in CMC and FTF groups=	-.945** (.399)	Yes
H3	Group Valence	Issue-based conflict will have a positive effect on DV	.021 (.163)	No
H4	Technology Adoption Level	Group Valence will have a positive effect on DV	.687*** (.102)	Yes
H5	Technology Adoption Level	Majority opinion regarding technology will have a positive effect on DV	.356* (.249)	Yes/Marginal
H6	Technology Adoption Level	Majority opinion regarding technology will positively moderate the effect of group valence on adoption	.389** (.215)	Yes
H7	Technology Adoption Level	Effect of majority will be lower in CMC groups than FTF groups	-.248 (.233)	No
H8a	Solution Satisfaction	Technology adoption level has a positive effect on DV	.134* (.085)	Yes/Marginal
H8b	Process Satisfaction	Technology adoption level has a positive effect on DV	.138* (.093)	Yes/Marginal
H8c	Solution Quality	Technology adoption level has a positive effect on DV	.091 (.051)	No

***p < .01; **p < .05; *p < .10

Contributions, Limitations, and Future Plans

This study attempts to develop and test a new model for group technology acceptance by drawing upon existing research in the areas of communication, groups, and technology adoption. The primary contribution of the research is that it extends the scope of current work on technology acceptance to another (very relevant) level of analysis, namely, that of groups, thereby providing a theoretical approach to the IS community for understanding and investigating various issues related to the group level acceptance phenomenon.

While a preliminary test of the GTAM model shows considerable empirical support, it is important to note that there was no control for the history of group members in our study, who were students randomly assigned to groups by the researchers. Prior history (as in some organizations) often affects the level of influence among group members. Further, we would like to mention that the study examined volitional use of technology, which is consistent with prior technology adoption literature, with the exception of some recent work (e.g., Brown et al. 2002).

Currently, the theoretical model is being refined, and preparations for a fresh round of experiments are being made. In the next round of experiments, the intent is to not only test the model proposed in this paper with a larger sample (estimated sample size is about 120 groups) but also test the effect of an additional variable, the influence of the leader, which has been shown to play a prominent role in the adoption of technologies by individuals (Sankar 1988), and was indicated as being a relevant factor by some participants. The eight-item scale of leadership credibility (Gabris and Ihrke 2000), and a new scale measuring the leader's opinion regarding the technology is being revised for this purpose.

References

Aarwal, R., and Prasad, J. "Are Individual Differences Germane to the Acceptance of New Information Technologies?," *Decision Sciences* (30:2), 1999, pp. 361-391.

Brown, S. A., Massey, A. P., Montoya-Weiss, M. M., and Burkman, J. R. "Do I Really Nave To? User Acceptance of Mandated Technology," *European Journal of Information Systems* (11:4), December 2002, pp. 283-295.

Curchill, Jr., G. A. "A Paradigm for Developing Better Measures of Marketing Constructs," *Journal of Marketing Research* (16), 1989, pp. 64-73.

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science* (35:8), 1989, pp. 982-1003.

Fisher, B. A., and Ellis, D. G. *Small Group Decision Making: Communication and the Group Process* (3rd ed.), McGraw Hill Publishing Company, New York, 1990.

Gabris, G. T., and Ihrke, D. M. "Improving Employee Acceptance Toward Performance Appraisal and Merit Pay Systems," *Review of Public Personnel Administration* (20:1), 2000, pp. 41-53.

Gefen, D., and Keil, M. "The Impact of Developer Responsiveness on Perceptions of Usefulness and Ease of Use: An Extension of the Technology Acceptance Model," *The DATABASE for Advances in Information Systems* (29:2), 1998, pp. 35-49.

Green, S. G., and Taber, T. D. "The Effects of Three Social Decision Schemes on Decision Group Process," *Organizational Behavior and Human Decision Processes* (25), 1980, pp. 97-106.

Hoffman, L. R., and Kleinman, G. B. "Individual and Group in Group Problem-Solving: The Valence Model Redressed," *Human Communication Research* (21:1), 1994, pp. 36-59.

Jehn, K. A., and Chatman, J. A. "The Influence of Proportional and Perceptual Conflict Composition on Team Performance," *International Journal of Conflict Management* (11:1), 2000, pp. 56-73.

Jehn, K. A., and Mannix, E. A "The Dynamic Nature of Conflict: A Longitudinal Study of Intragroup Conflict and Group Performance," *Academy of Management Journal* (44:2), 2001, pp. 238-251.

Karahanna, E., and Straub, D. W. "The Psychological Origins of Perceived Usefulness and Ease-of-Use," *Information & Management* (35:4), 1999, pp. 237-250.

Lucas, H. C., and Spitler, V. K "Technology Use and Performance: A Field Study of Broker Workstations," *Decision Sciences* (30:3), 1999, pp. 291-311.

McGrath, J. E. *Groups: Interaction and Performance*, Prentice Hall, Inc., Englewood Cliffs, NJ, 1984.

McGrath, J. E., and Hollingshead, A. B. "Putting the 'Group' Back in Group Support Systems: Some Theoretical issues About Dynamic Processes in Groups with Technological Enhancements" in *Group Support Systems: New Perspectives*, L. M. Jessup and J. S. Valacich (eds.), Macmillan Publishing Company, New York, 1993, pp. 78-96.

McPhee, R. D., Poole, M. S., and Seibold, D. R. "The Valence Model Unveiled: Critique and Alternative Formulation." in *Communication Yearbook 5*, M. Burgoon (ed.), Transaction Books, New Brunswick, NJ, 1982, pp. 259-278.

Mennecke, B. E., and Valacich, J. S. "Information Is What You Make of It: The Influence of Group History and Computer Support on Information Sharing, Decision Quality, and Member Perceptions," *Journal of Management Information Systems* (15:2), Fall 1998, pp. 173-198.

Meyers, R. A., and Brashers, D. E. "Influence Processes in Group interaction," in *The Handbook of Group Communication Theory and Research*, L. R. Frey (ed.), Sage Publication, Thousand Oaks, CA, 1999, pp. 288-312.

Miranda, S. M., and Bostrom, R. P. "The Impact of Group Support Systems on Group Conflict and Conflict Management," *Journal of Management Information Systems* (10:3), Winter 1993-94, pp. 63-95.

Plouffe, C. R., Hulland, J. S., and Vanderbosch, M. "Research Report: Richness Versus Parsimony in Modeling Technology Adoption Decisions—Understanding Merchant Adoption of a Smart Card-Based Payment System," *Information Systems Research* (12:2), 2001, pp. 208-222.

Ramarupa, N. K., Simkin, M. G., and Raisinghani, M. "The Analysis and Study of the Impact of Technology on Groups: A Conceptual Framework," *International Journal of Information Management* (19:2), 1999, pp. 157-172.

Ryan, S. D., Bordoloi, B., and Harrison, D. A. "Acquiring Conceptual Data Modeling Skills: The Effect of Cooperative Learning and Self-Efficacy on Learning Outcomes," *The DATABASE for Advances in Information Systems* (31:4), 2000, pp. 9-24.

Sanders, G. S., and Baron, R. S. "Is Social Comparison Irrelevant for Reducing Choice Shifts," *Journal of Experimental Social Psychology* (13), 1977, pp. 303-314.

Sankar, Y. "Organization Culture and New Technologies," *Journal of Systems Management* (39:4), April 1988, pp. 10-17.

Shaw, M. E. *Group Dynamics: The Psychology of Small Group Behavior*, McGraw-Hill Book Company, New York, 1981.

Tan, B. C. Y., Wei, K. K., Watson, R. T., Clapper, D. L., and McLean, E. R "Computer-Mediated Communication and Majority Influence: Assessing the Impact in an Individualistic and a Collectivistic Culture," *Management Science* (44:9), 1998, pp. 1263-1278.

Taylor, S., and Todd, P. A. "Understanding Information Technology Usage: A Test of Competing Models," *Information Systems Research* (6:2), 1995, pp. 144-176.

Venkatesh, V., and Davis, F. D. "A Model of the Perceived Ease of Use Development and Test," *Decision Sciences* (27:3), 1996, pp. 451-481.

Venkatesh, V., and Davis, F. D. "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies," *Management Science* (46:2), 2000, pp. 186-204.

Venkatesh, V., and Morris, M. G. "Why Don't Men Ever Stop to Ask for Directions? Gender, Social Influence, and Their Role in Technology Acceptance and Usage Behavior," *MIS Quarterly* (24:1), 2000, pp. 115-139.

Wheeler, B. C., and Valacich, J. S. "Facilitation, GSS, and Training as Sources of Process Restrictiveness and Guidance for Structured Group Decision Making: An Empirical Assessment," *Information Systems Research* (7:4), 1996, pp. 429-450.

Zigurs, I. "Methodological and Measurement Issues in Group Support Systems Research," in *Group Support Systems: New Perspectives*, L. M. Jessup and J. S. Valacich (eds.), Macmillan Publishing Company, New York, 1993, pp. 112-122.

Zigurs, I, DeSanctis, G., and Billingsley, J. "Adoption Patterns and Attitudinal Development in Computer-Supported Meetings: An Exploratory Study," *Journal of Management Information Systems* (7:4), 1991, pp. 51-70.

Zigurs, I., Poole, M. S., and DeSanctis, G. L. "A Study of Influence in Computer-Mediated Group Decision Making," *MIS Quarterly* (12:4), 1988, pp. 625-644.