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Effects of Electronic Communication Technology on Top Management Teams' Structures and Decision-Making Process Outcome

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Abstract

Drawing on Huber's (1990; Huber et al. 1993) propositions concerning the effects of advanced information technology (AIT) on organizational structure, intelligence, and decision making, this paper examines the effects of the use of electronic communication technologies (ECT) on top management team (TMT) structure and decision-making processes and outcomes. Eight specific hypotheses are developed from Huber's propositions and tested, using data collected from 84 TMTs. The results indicate that ECT use by a TMT is positively correlated with the participation of outsiders in the TMT's decision-making processes, the reduction in the number of organizational levels involved in decision making processes, and the number of alternatives considered during the TMT's decision-making processes. However, contrary to the Huber's prediction, ECT use is positively correlated with a TMT's size and the formality of decision-making processes. Implications for future research and practice are also provided, along with theoretical and methodological limitations.

Keywords: Top management team, electronic communication technology, decision-making processes, organizational structure.

1. INTRODUCTION

As we move into the twenty-first century, an increasing number of organizations are using electronic communication technology (ECT)[1] to organize themselves and to connect people, both inside and outside their organizational boundaries (Fulk and DeSanctis 1995). Current exemplar applications includes group support systems (GSS), groupware software, e-mail systems, Internet/intranet applications, and distributed group scheduling software. Both the academic and the practical press have been preaching that ECT use will lead to a leaner, faster, and better organization (*Businessweek* 1995; Davenport 1992; Drucker 1988; Malone and Rockart 1993; Tapscott and Castone 1993). It is not too soon, however, to ask whether these technologies are indeed bringing positive changes in organizational structure, decision-making process, and outcome. While there have been few anecdotal case studies that demonstrate the impact of ECT on organizational structure and decision making process and outcomes, there is a need to conduct a theory-based empirical investigation utilizing a large sample.

Huber (1990) sets forth a theory regarding the effects of advanced information technologies (AITs) on organizational design, intelligence, and decision making. He argues that AIT use will bring about changes in organizational

[1]ECT is defined broadly here as including a set of technologies that enable communication, information sharing, and collaboration among a group of people in different locations through electronic communication networks.

structure, organizational decision-making processes and the quality of decision making. However, Huber specified AIT quite loosely, leaving room for specifications of the theory to particular kinds of technology. For example, Huber et al. (1993) further refined the theory to predict the impact of GSS on organizational structure and decision-making process and outcome.

Although Huber's theory and its associated propositions are both insightful and somewhat controversial, few major empirical efforts have been undertaken to test his theory. Leidner and Elam (1995) applied Huber's theory in the context of executive information systems (EIS) usage by managers. They found Huber's predictions regarding the effects of AIT to be substantiated. More specifically, they found that the use of EIS was positively related to (1) the speed of problem identification by the managers, (2) the speed of decision making, and (3) the information availability. Although Leidner and Elam's study provides empirical evidence for Huber's theory, their research examined individual managers, while Huber focused on the firm. As such, there is a need for a more direct empirical testing of Huber's theory at the firm level.

Also, given the potential effects of ECT to organizational design and performance, one might expect an even greater impact by ECT on organizational structures and decision-making process and outcomes than with EIS. Huber et al. provides a useful theoretical framework to examine this important issue.

Motivated by this gap in the literature, this paper investigates the effects of ECT use by a top management team (TMT) on its structure and decision-making process and outcomes. Building on Huber's key idea that AIT would prompt changes in the organizational design that affect quality and timeliness of intelligence and decision making, the intensity of ECT usage among TMT members is identified as a key factor in causing changes to TMT structure (i.e., size and heterogeneity), TMT decision-making process (i.e., the length of the decision-making process, the number of people participating in the decision-making process, the formality of the decision-making process, and the number of organizational levels involved the in decision-making process), and TMT decision-making outcomes (i.e., time to react to competitive challenges and the number of alternatives considered). These hypotheses were tested using a data set collected from 59 U.S. and 25 Irish firms.

The theoretical model used here to develop these hypotheses assumes rational organizational actors. It also takes the *technology-imperative* perspective (Markus and Robey 1988). That is, it treats the technology as an exogenous variable and predicts the "impacts" of this exogenous variable on an organization. The paper acknowledges, however, that there is an accumulating body of empirical evidence (e.g., Barley 1986; Orlikowski 1992) that supports a different theoretical perspective (e.g., Orlikowski and Robey 1991; Robey 1995). This perspective, which is labeled the *emergent perspective* by Markus and Robey (1986), posits that information technology (IT) is both the cause and outcome of organizational change and argues that one cannot draw a causal relationship between IT and organization structure. According to this perspective, it is the dynamic interplay between organizational structure and IT that determines the consequences of the use of IT in organizations.

A discussion of the differences between these two theoretical perspectives is well beyond the scope of this paper. Instead, readers should note the theoretical assumptions made here. The limitations and implications of these theoretical assumptions will be discussed later in the paper.

2. THEORETICAL FOUNDATIONS AND HYPOTHESES

2.1 Why and How to Study a TMT

A TMT is a team of senior executives that directly supports the chief executive officer (CEO) for strategic issues, external relations, and overall corporate governance (Ancona and Nadler 1989). According to a survey (Vancil 1987), the TMT model is rapidly replacing the more traditional CEO/COO (chief operating officer) "two-person"

model as the dominant form of organizing major U.S. corporations at the executive level. Typically, a TMT consists of a CEO (as the leader) and a group of vice presidents responsible for particular strategic "sectors" of the company and its supporting staff functions (Ancona and Nadler 1989).

Unlike other teams in organizations, the tasks of a TMT are highly visible to external environments, highly complex, highly uncertain, and socially complex (Ancona 1989). Furthermore, a TMT differs from other teams in that the effectiveness of a TMT is expected to have significant impact on overall organizational performance (e.g., Smith et al. 1995). For example, TMT behavior has been shown to be vital to effective organizational evolution in a study of the minicomputer industry (Tushman and Anderson 1986). TMT heterogeneity has been found to be directly related to firms' competitive moves in the airline industry (Hambrick et al. 1996). There are several case studies that present industrial giants who, with a selected TMT, have brought a new organizational gestalt and reversed organizational performance (Miller and Friesen 1980; Samuelson et al. 1985).

Given the importance of TMT effectiveness, it is imperative to identify which factors affect the effectiveness of a TMT. There are two competing perspectives on TMT effectiveness: demography perspective and process perspective. Drawing on Pfeffer's (1983) argument that research will find direct effects of TMT demography on TMT performance because it will be impossible to measure all of the potential intervening process variables, the demography perspective (e.g., Hambrick et al. 1996; Hambrick and D'Aveni 1992; Hambrick and Mason 1984; Michel and Hambrick 1992; Murray 1989; Pelled 1996) argues that TMT structural variables such as team size, team heterogeneity, and team tenure will affect the TMT effectiveness. Drawing on social psychology research (McGrath 1984; Shaw 1981), the process perspective argues that the TMT decision-making process affects TMT effectiveness (Dean and Sharfman 1996; Iaquinto and Fredrickson 1997). Despite ongoing debates between these two perspectives, recent empirical studies show that the truth lies between these two (Lawrence 1997; Smith et al. 1995). Consistent with these recent empirical findings, the current paper examines the effects of ECT use on TMT structure, process and outcomes.

2.2 ECT and TMT Structures

Huber provides two predictions regarding the impacts of AIT on decision-making unit structure. He predicts that AIT use will decrease the size and the heterogeneity of members comprising the traditional face-to-face decision unit (p. 55, proposition 2). This prediction is based on two assumptions. First, small groups are more effective and efficient in making decisions and provide more satisfying experiences. Second, AIT will facilitate more rapid and frequent communications across the boundaries between small groups. Based on these two assumptions, he argues that, since people can make their knowledge and concerns available through AIT even if they are not part of the team, the face-to-face decision-making groups will become smaller and less heterogeneous.

Applying these predictions in the context of ECT's influence on TMT structure, it is hypothesized that ECT use will lead to a smaller and more homogeneous TMT:

H1: TMTs that use ECT intensely will have a smaller team size than TMTs that use ECT less intensely.

H2: TMTs that use ECT intensely will have a lower degree of heterogeneity among the TMT members than TMTs that use ECT less intensely.

2.2 ECT and TMT Decision-Making Processes

Huber makes several predictions regarding the impacts of AIT on the organizational decision-making process. First, he argues that AIT use will lead to larger and more heterogeneous groups of people participating in organizational decision-making processes (p. 53, proposition 1). Second, he argues that, through AIT use, less of the organization's

time will be absorbed by decision-making meetings (p. 56, proposition 3). Third, he argues that AIT use will lead to a less formal organizational decision-making process (p. 57, proposition 5). Finally, he argues that AIT use will reduce the number of human information processing nodes (p. 60, proposition 7) and the number of organizational levels involved in processing messages (p. 60, proposition 7a).

Huber et al. make similar predictions regarding the impact of GSS on the decision-making process. First, they argue that GSS use will increase the number of people participating in the decision-making process, especially when the problem is unclearly defined and information necessary for problem solving is ambiguously specified. Given the nature of the problems that a TMT has to deal with, it is expected that ECT use by a TMT will increase the number and the heterogeneity of the people participating in the TMT decision-making process. This does not mean an increase in the size of the team (see hypotheses 1). Instead, it means an increase in the number of outsiders participating and influencing the TMT's decision-making process. Therefore, it is hypothesized:

> H3: TMTs that use ECT intensely will have a larger number of outsiders participating in the TMT's decision-making processes than TMTs that use ECT less intensely.

Past research in electronic group decision support has found that groups in electronic communication environments tend to spend significantly less time in reaching conclusions (e.g., Benbasat and Lim 1993; Dennis and Gallupe 1993). Thus, it is hypothesized that ECT use will reduce the time required to make decisions by TMTs:

> H4: TMTs that use ECT intensely will take less time in decision-making processes than TMTs that use ECT less intensely.

Formalization refers to adherence to standards, norms, and rules. Many organization theorists have argued that new organizational structures based on information technology will be more flexible and open, encouraging open communication and wide information sharing across organizational hierarchy and boundaries (Drucker 1988; Malone and Rockart 1993; Tapscott and Caston 1993). These observations are consistent with Huber's argument that AIT will make organization less formal. Huber et al. also argue that, when the organization's upper echelon seeks higher quality decision, GSS use will lead to more decentralization in the organization. Similarly, it is hypothesized that ECT use is expected to reduce the formality of the organization.

> H5: TMTs that use ECT intensely will have less formal decision-making processes than TMTs that use ECT less intensely.

Huber argues that AIT use will lead to vertical distribution of information and knowledge across organizational levels. This will lead to reduction in the number of organizational levels involved in organizational decision-making. For similar reasons, he predicts that the number of human information processing nodes in organizations will be reduced as a result of AIT use. Huber et al. make similar arguments regarding the impact of GSS on the decision-making process, focusing on improved information sharing by GSS use. As organizations become flatter, with a smaller number of hierarchies involved in the decision-making process, one can expect to see managers managing a larger number of non-managing employees. As such, it is hypothesized that ECT use by a TMT will lead to a larger number of non-managing employees per manager.

> H6: Companies whose TMT uses ECT intensely will have a larger number of non-managing employee per manager than companies whose TMT uses ECT less intensely.

2.4 ECT and TMT Decision Making Outcomes

Finally, Huber makes several predications regarding the impact of AIT on organizational decision-making outcomes. Specifically, he argues that AIT use will lead to more rapid and more accurate identification of problems and opportunities (p. 63, proposition 10). This can reduce the time it takes for an organization to take a strategic reaction to unexpected competitive challenges (p. 64, proposition 13). Huber et al. make a similar prediction regarding the role of GSS in decision making time (p. 268, proposition 14). Consistent with these observations, it is hypothesized here that ECT use by a TMT will lead to faster strategic reactions taken by the TMT to competitive challenges.

H7: TMTs that use ECT intensely will take less time in reacting to competitive challenges than TMTs that use ECT less intensely.

Huber argues that AIT will lead to higher quality decisions. According to group decision-making literature, one of the important antecedent variables for higher quality decision making is the number of alternatives considered (e.g., Russo and Schoemaker 1989). An individual's limited cognitive capacity often fails to generate a large and comprehensive set of alternatives. Techniques such as systematic brainstorming or nominal groups technique (NGT) have been proposed as potential cures for this problem (e.g., Osborn 1953; Van Gundy 1981). Proponents of ECT in the organizational decision-making process have argued that ECT can enhance the group decision-making process by facilitating such structured group decision-making strategies (e.g., Valacich et al. 1994). Among the advantages of ECT in the group decision-making process is an increase in the number of alternatives considered by the members during the decision-making process (Benbasat and Lim 1993; Dennis and Gallupe 1993; Gallupe et al. 1991). Therefore, it is hypothesized:

H8: TMTs that use ECT intensely will consider more alternatives during decision-making processes than TMTs that use ECT less intensely.

3. RESEARCH METHOD

3.1 Subjects and Procedures

The data used in this paper to test the hypotheses advanced in the previous section was collected as a part of a larger study (Smith et al. 1995). The target population for the study was TMTs of a set of single-business technology-based companies. Consistent with Huber's theory, the unit of analysis was the firm. The members of the TMT for each firm were identified by the CEO of the company. All members of the TMT, including the CEO, were asked to complete questionnaires, which were then aggregated at the firm level There were 59 U.S. firms and 25 Irish firms with similar characteristics, resulting in a total of 84 firms. The companies in the sample ranged in size, measured in gross sales, from $200 thousand to $330 million. Mean sales were $33 million with a standard deviation of $47 million. The mean size of firms in number of employees was 290, with a standard deviation of 344. (For a more detailed description of the data set and data collection procedure, see Smith et al. 1995.)

3.2 TMT Use of ECT

To measure a TMT's usage frequency of ECT, each respondent was asked about his/her weekly usage frequency for nine different types of communication media: formal face-to-face meetings, informal face-to-face meeting, individual telephone conversations, telephone conference calls, voice mail, formal written communications, informal written communications, electronic mail, and electronic conferencing. Among these nine media, formal and informal face-

to-face meetings, individual telephone conversations, telephone conference calls, and formal and informal written communications were categorized as traditional communication technology (TCT); electronic mail, electronic conferencing and voice mail were categorized as ECT. Separate usage frequencies, for TCT and ECT, were calculated for each respondent by summing his/her weekly usage frequency of individual media in each category. Individual usage frequencies were averaged for each TMT. This gave an average usage frequency for TCT and ECT for each TMT.

A k-mean cluster analysis was then performed using these two frequency variables to divide the samples in two groups: (1) ECT intensive TMTs and (2) ECT non-intensive TMTs. The cluster analysis yielded 10 ECT intensive TMTs (ECT group, hereafter) and 72 ECT non-intensive TMTs (TCT group, hereafter).[2] The intensity of ECT use (IECTU) was calculated for each TMT by:

$$\text{IECTU} = \frac{\text{Average weekly usage of ECT by TMT}}{\text{Average weekly usage of TCT by TMT}}$$

Higher scores of IECTU indicate more intensive use of ECT by TMT. The average IECTU for was 0.8340 and 0.1284 for ECT group and TCT groups, respectively ($F(1, 80) = 35.345 < 0.001$).

3.3 Dependent Variables

3.3.1 TMT Structure

Team size. The size of the team was measured by a single item: the number of TMT members as defined by the CEO of each firm.

Team heterogeneity. TMT heterogeneity was measured by the variation in functional backgrounds among TMT members. TMT members were asked to identify the functional category that most closely represents their backgrounds. Functional heterogeneity was measured in terms of Blau's (1977) heterogeneity index: $(1-\Sigma i^2)$, where i is the proportion of the group in the i^{th} category. A high score on this index indicates variability in the functional background among TMT members or functional heterogeneity; a low score represents greater functional homogeneity.

3.3.2 TMT Decision-Making Process

Number of outsiders participating in the TMT's decision-making processes. To measure the number of outsiders participating in the TMT's decision-making processes, the CEO of each firm was asked about the number of people participating in decision-making processes from plant and headquarters in addition to the regular TMT members.

Time spent in decision making meetings. To measure the time spend in TMT decision making meetings, each respondent was asked (1) how often the TMT meets per week and (2) on average how long each of those meetings lasts. Then these two numbers were multiplied and averaged for each TMT to calculate a single index of the average length of the TMT's decision-making meetings.

[2]Two firms were dropped from the data analysis due to missing values.

Formality of decision making process. Organizational formality was measured by four Likert-type questionnaire items designed by Smith et al. (1995). The items (see the appendix) included "TMT meetings tend to be very formal in nature" and "Our TMT employs informal rather than formal communication channels (reverse coded)." These four items were averaged to form the formality of decision-making process index (alpha = .75). A one-way analysis of variance was performed on the formality index to determine if there was a greater variability in the ratings between organizations than within organizations (Winer 1971). The F-ratio was significant ($F = 2.83$; $p < 0.001$), indicating that the individual scores could be aggregated to the group level. An interrater reliability coefficient (James coefficient) was used to examine the intra-group reliability of response (James et al. 1984). The average intragroup reliability for this scale was .92. Thus, a measure of communication formality was calculated for each TMT by averaging across TMT members' scores. Higher scores indicate a more formal decision-making process.

Number of non-managing employees per manager. The numbers of non-managing employees and the number of people with managerial responsibility were acquired from the *Standard and Pool* on-line database. These two numbers were used to calculate the number of non-managing employees per manager for each company included in the study.

3.3.3 TMT Decision-Making Outcomes

Reaction time to competitive challenges. To measure the reaction time to competitive challenges, the CEO of each firm was asked how long it takes for his/her company to take a strategic reaction to competitive challenges. The mean was 2.56 hours.

Number of alternatives considered.. To measure the number of alternatives considered by each TMT, the CEO of each firm was asked to provide an average number of alternatives to be considered during their typical strategic decision-making processes.

4. EMPIRICAL ANALYSES AND RESULTS

Table 1 shows the means, standard deviations, and Pearson correlations among the variables examined in this study. The results are presented for the impact of ECT use on TMT structure, TMT decision-making process, and TMT decision-making outcomes. In line with the unit of analysis, all the values reported were measured at the firm level.

Table 2 reports the results of one-way ANOVA tests comparing the differences between ECT group and TCT group on eight dependent variables, along with means and standard deviations of each variable for both groups.

Contrary to expectations, TMTs that used ECT intensely had a larger team size than TMTs that used ECT less intensely. Therefore, H1 was contradicted. ECT use did not have a significant impact on team heterogeneity, rejecting H2. Overall, ECT use by a TMT did not show the expected relationships with the TMT's structure.

On the other hand, ECT use by a TMT had somewhat expected effects on the TMT's decision-making processes. First, ECT use increased the participation of outsiders in a TMT's decision-making process (supporting H3) and the number of non-managing employees per manager (supporting H6). Contrary to expectations, however, ECT use by a TMT was positively related with the formality in the TMT's decision-making process. Therefore, H5 was contradicted. There were no significant differences in the average length of decision making meetings between the two groups (rejecting H4).

Table 1. Means, Standard Deviations, and Correlations

Variables		1	2	3	4	5	6	7	8	9
ECT intensity	1.	1.00								
Team size	2.	.437**	1.00							
Heterogeneity	3.	-.098	.242*	1.00						
Number of outsiders	4.	.310**	.447**	0.87	1.00					
Meeting length	5.	-.039	.408**	.289**	.243	1.00				
Formality	6.	.112	.398**	.357**	.093	.075	1.00			
Organizational level	7.	.120	.272	-.055	.081	.107	.266*	1.00		
Reaction time	8.	.136	-.175	-.273*	-.043	-.270*	-.028	.019	1.00	
Number of alternatives	9.	-.016	-.015	.142	.164	.072	.096	.211	.164	1.00
Mean		.2145	5.04	.5192	4.39	2433.89	2.2950	16.2627	2.58	3.80
S.D.		.4196	2.18	.2484	1.89	1752.23	.5171	25.4863	1.06	5.13

*p 0.05; **p < 0.01 (two-tailed test)

Table 2. Results of One-Way ANOVA

	Mean (S.D.)			
Hypothesis	**ECT Group**	**TCT Group**	**F-value**	**Support**
H1 Team size	6.86 (2.73)	4.85 (1.95)	5.829*	Contradicted
H2 Heterogeneity	0.52 (0.14)	0.53 (0.25)	0.009	Not significant
H3 Number of outsiders	6.20 (3.68)	4.14 (1.34)	11.633**	Supported
H4 Meeting length	2528.27 (715.14)	2344.69 (1853.34)	0.095	Not significant
H5 Formality	2.61 (0.49)	2.26 (0.51)	4.197*	Contradicted
H6 Organizational level	36.24 (32.05)	13.85 (23.67)	6.526*	Supported
H7 Reaction time	2.10 (0.74	2.36 (1.10)	2.142	Not significant
H7 Number of alternatives	7.75 (10.33)	3.26 (3.83)	5.673*	Supported

*p < 0.05; **p < 0.01 (two-tailed test)

Finally, the results showed that ECT use by a TMT increased the number of alternatives considered during the TMT's decision-making process (supporting H8). There was no statistical difference between the two groups in terms of strategic reaction time to competitive challenges (rejecting H7) at 0.05 significance level. However, H7 was still directionally supported and was significant at a more liberal 0.1 significance level. Hence, it can be stated that overall ECT use by a TMT enhances the outcome of the TMT's decision-making outcomes.

5. DISCUSSION AND CONCLUSIONS

5.1 ECT and TMT Decision-Making Process and Outcomes

This research tested Huber's propositions and found empirical support for some of his propositions. Generally speaking, it found that ECT use by a TMT positively influences the TMT's decision-making processes and outcomes.

First, ECT use by a TMT was found to be positively correlated with the participation of outsiders in the TMT's decision-making processes, as predicted by Huber. Dean and Sharfman report that procedural rationality in strategic decision-making process affects the effectiveness of strategic decisions. Kim and Mauborgne (1995) report that procedural justice in strategic decision-making process in a multinational company strongly affects the multinational company's ability to achieve its strategic objectives. The results of these studies highlight the importance of TMT decision-making process. The results of the current study suggest that ECT use by a TMT can improve the quality of the TMT's strategic decision-making process by allowing more outsiders to participate in decision-making processes.

Second, the results provide empirical evidence that ECT use can flatten the organization's hierarchy as suggested by many IS scholars (e.g., Drucker 1988; Malone and Rockart 1993). Proponents of IS-based business process reengineering (BPR) have argued that flat organizations can respond and adopt to the changing environments more effectively and faster than traditional hierarchical organizations by eliminating unnecessary human information processing nodes in the organizational decision-making hierarchy and utilizing information and telecommunication technologies (e.g., Davenport 1992; Hammer and Champy 1993). The results of the current study show that ECT can be effectively used to reduce the levels of organizational hierarchy.

Finally, the results indicate that ECT use is positively correlated with the effectiveness of a TMT's decision-making outcomes, especially measured by the number of alternatives considered during the decision-making process. As discussed earlier, the human decision-making process often fails to consider all of the possible alternatives before reaching the final decision (Russo and Shoemaker 1989). The results of the current study replicate the findings of computer-supported electronic group decision-making research that found computer-supported groups generated a larger number of unique ideas than groups working in face-to-face environments (e.g., Benbasat and Lim 1993; Dennis and Gallupe 1993; Gallupe et al. 1991). Given the fact that the ultimate result of a TMT's decision making is the performance of the firm, future research can investigate the relationship between ECT use by a TMT and the economic performance of the firm.

5.2 ECT, Team Size, and Formality

It is interesting to note that the data indicate that ECT use by a TMT has the opposite effect on team size and formality in the decision-making process from what was originally expected. First, team size was found to be positively correlated with ECT use by a TMT. It is possible to posit that a large team size is not a result of ECT use by the TMT but rather an antecedent of it. In other words, a large TMT may have more difficulties in coordinating

and communicating among team members via traditional communication media such as face-to-face meetings or individual telephone conversations than a small TMT. Therefore, the large TMT may actively adopt ECT, which provides speed and flexibility to its coordination and communication and as a result the TMT can expand its size to a larger degree. Unlike a large TMT, however, a small TMT may not experience difficulty in coordination and communication among its members with traditional media and continue their established communication patterns without adopting new ETC.

Second, ECT use was found to be positively correlated with formality in the decision-making process. It is possible that both ECT use by a TMT and formality are correlated to an external factor, environmental stability. According to Galbraith (1973), when organizations face unstable environments, they can absorb the uncertainties in environments by formalizing their decision-making process or utilizing IT. Additional post hoc data analysis revealed that both formality in the decision-making process and ECT use are positively correlated with the environmental stability perceived by the CEO, supporting this line of reasoning.

5.3 Comparison with Leidner and Elam

It is also interesting to compare the findings of the current study with those of Leidner and Elam, who also tested Huber's theory at the individual manager level with EIS technology. They found that EIS use by a manager did not change the level of involvement of subordinates in organizational decision-making and intelligence processes. This is contrary to the current findings, which show that ECT use by a TMT is positively correlated with the participation of outsiders into the TMT's decision-making process. It is possible that this difference is due to the differences between the technologies involved in the two studies. That is, EIS is primarily developed to support individual decision makers, while ECT is developed to support groups of decision makers. Thus, it seems that EIS use reduces the needs of subordinates' support in the decision-making process by improving an individual manager's decision making capability, while ECT use increases the participation of subordinates in the decision-making process through an increased communication channel. Although both of these technologies can certainly improve the quality of decision- making outcomes, it is evident from this comparison they operate through different paths. Hence, although both of these two technologies can be viewed as an AIT, one needs to specify the nature of the AIT before discussing its possible effects on organizational decisio- making processes and outcomes as suggested by Huber (p. 67).

5.4 Limitations

When interpreting the results of this study, it is important to note the assumptions of Huber's (1990; Huber et al. 1993) theory, which is the theoretical basis of this empirical work. His theory takes a technology-imperative perspective, which emphasizes the role of IT in determining the organizational performance. This perspective implies a causal relationship between the use of IT and organizational consequences. As such, all of the hypotheses in this paper imply causal relationships between ECT use and organizational structure and decision-making process and outcomes. However, if one takes an alternative perspective (e.g., Orlikowski and Robey 1991), the relationship between IT and organizational consequences is reciprocal and correlational. Given the fact that a cross sectional data set, which allows only correlational analysis, was employed, the empirical results presented here do not preclude an interpretation based on the emergent perspective. In fact, some of the findings can be explained with the emergent perspective, and allude to the existence of reciprocal relationships between IT and organizational consequences. For example, with the evidence of a strong positive relationship between ECT use by TMT and the number of alternatives considered during the decision-making process, the emergent perspective would argue that a TMT that already has a strong norm of considering a large number of alternatives before making final decisions may actively utilize ECT during its decision-making process, because, it would argue, the members of the TMT believe ECT can support the

established norms. On the other hand, the same result can be viewed as evidence of a causal relationship between ECT use and positive decision-making outcomes from the technology-imperative perspective.

So, what does all of this mean? First, we believe that one should not attempt to establish a causal relationship between ECT use and organizational consequences based solely on empirical data, especially cross-sectional data. Instead, the causal relationship should be established based on a theory. The causal hypotheses and interpretations in this paper were based on the theoretical position that was taken at the outset. Second, given the mixed results and possible alternative interpretations of the results based on the emergent, we believe the truth lies somewhere between the extreme positions of these two perspectives. In other words, to a certain extent, we believe, ECT use does cause changes in organizational performance and structure in a positive way. However, we also believe that the use of IT is somewhat affected by the existing organizational norms and culture, which might result in unintended consequences for ECT use in certain situations. The results presented in this paper should be interpreted, therefore, with consideration of this theoretical limitation.

Besides the theoretical limitation, it is also equally important to note limitations in the research methodology employed in this study. A first methodological limitation is regarding the way some of the variables were measured. That is, several measures were collected by a single response from the CEO. It is possible, therefore, the results may reflect biased views of CEOs of the sample companies.

Second, the sample is limited to TMTs of technology-based firms. One can argue that since these firms are technology dependent, ECT use might have had a bigger impact on decision-making processes and outcomes with this sample than it would with TMTs from industries that are less technology dependent. Future research employing more general firm characteristics need to address this issue.

5.5 Implications for Future Research and Practice

Despite the theoretical and methodological limitations discussed above, the current study provides important implications for both future research and practice. First, given the fact that we found that both the technology-imperative and emergent perspectives can provide plausible interpretations of the empirical results found here, future research need to focus on theoretical integration of these two different theoretical perspectives with follow-up empirical investigations. This would require one to adopt the longitudinal research approach with process-oriented data analyses.

Second, from a practical standpoint, one can state that ECT use is related to some positive organizational characteristics, such as a flatter organization structure, more participation and involvement of employees in the organizational decision-making process, and consideration of a larger number of alternatives within a relatively short amount of time.

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7. REFERENCES

Ancona, D. G. "Top Management Teams: Preparing for the Revolution," in *Applied Social Psychological and Organizational Settings*, J. Carroll (ed.), Lawrence Erlbaum Associate Inc., Hillsdale, NJ, 1989.

Ancona, D. G., and Nadler, D. A. "Teamwork at the Top: Creating High Performing Executive Teams," *Sloan Management Review*, (31), Fall 1989, pp. 19-28.

Barley, S. "Technology as an Occasion for Structuring: Evidence From Observation of CT Scanners and the Social Order of Radiology Departments," *Administrative Science Quarterly* (31), 1986, pp. 78-108.

Benbasat, I., and Lim, L. "The Effects of the Group, Task, Context, and Technology Variables on the Usefulness of Group Support Systems: A Meta-Analysis of Experimental Studies," *Small Group Research* (24:4), 1993, pp. 430-462.

Blau, P. *Inequality and Heterogeneity: A Primitive Theory of Social Structure*, Free Press, New York, 1977.

Businessweek. "The Networked Corporation: Linking Up Is Hard To Do – But It's a Necessity," June 26, 1995, pp. 86 - 114.

Davenport, T. H. *Process Innovation: Reengineering Work Through IT*, Harvard Business School Press, Boston, 1992.

Dean Jr., J. W., and Sharfman, M. P. "Does Decision Process Matter? A Study of Strategic Decision-Making Effectiveness," *Academy of Management Journal* (39:2), 1996, pp. 368-396.

Dennis, A. R., and Gallupe, R. B. "A History of Group Support Systems Empirical Research: Lessons Learned and Future Directions," in *Group Support Systems: New Perspectives*, L. M. Jessup and J. S. Valacich (eds.), Macmillan, New York, 1993.

Drucker, P. F. "Coming of New Organizations," *Harvard Business Review*, January-February 1988, pp. 45-53.

Galbraith, J. R. *Designing Complex Organizations*, Addison-Wesley, Reading, MA, 1973.

Gallupe, R. B.; Bastianutti, L. M.; and Cooper, W. H. "Unblocking Brainstorming," *Journal of Applied Psychology (*76:1), 1991, pp. 137-142.

Fulk, J., and DeSanctis, G. "Electronic Communication and Changing Organizational Forms," *Organization Science* (6:4), 1995, pp. 337-349.

Hambrick, D.; Cho. T. S.; and Chen, M. "The Influence of Top Management Team Heterogeneity on Firms' Competitive Moves," *Administrative Science Quarterly* (41:4), 1996, pp. 659-684.

Hambrick, D., and D'Aveni, R. "Top Team Deterioration as Part of the Downward Spiral of Large Corporate Bankruptcies," *Management Science* (38), 1992, pp. 1445-1466.

Hambrick, D., and Mason, P. A. "Upper Echelons: The Organization as a Reflection of Its Top Managers," *Academy of Management Review* (9), 1984, pp. 193-206.

Hammer, M., and Champy, J. *Reengineering the Corporation: A Manifesto for Business Revolution*, Harper Press, New York, 1993.

Huber, G. P. "A Theory of the Effects of Advanced Information Technologies on Organizational Design, Intelligence, and Decision Making," *Academy of Management Review* (15:1.), 1990, pp. 47-71.

Huber, G. P.;Valacich, J. S.;and Jessup, L. M. "A Theory of the Effects of Group Support Systems on Organization's Nature and Decisions," in *Group Support Systems: New Perspectives*, L. M. Jessup and J. S. Valacich (eds), Macmillan, New York, 1993, pp. 255-269.

Iaquinto, A. L., and Fredrickson, J. W. "Top Management Team Agreement About the Strategic Decision Process: A Test of Some of Its Determinants and Consequences," *Strategic Management Journal* (18:1), 1997, pp. 63-75.

James, L. R.; Demaree, R. G.; and Wolf, G. "Estimating Within-Group Interrater Reliability With and Without Response Bias," *Journal of Applied Psychology* (69), 1984, pp. 85-98.

Kim, W., and Mauborgne, R. A. "A Procedural Justice Model of Strategic Decision Making: Strategy Content Implications in the Multination," *Organization Science* (6:1), 1995, pp. 44-61.

Lawrence, B. S. "The Black Box of Organizational Demography," *Organization Science* (8:1), 1997, pp. 1-22.

Leidner, D. E., and Elam, J. J. "The Impact of Executive Information Systems on Organizational Design, Intelligence, and Decision Making," *Organization Science* (6:6), 1995, pp. 645-664.

Malone, T. W., and Rockart, J. F. "How Will Information Yechnology Reshape Organizations? Computers as Coordination Technology," in *Globalization, Technology and Competition: A Fusion of Computer and Technology in the 1990s*, S. P. Bradley, J. A. Hausman, and R. L. Nolan (eds.), Harvard Business School Press, Boston, 1993, pp. 35-76.

Markus, M. L. and Robey, D. "Information Technology and Organizational change: Causal Structure in Theory and Research," *Management Science* (34), 1988, pp. 583-598.

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

Michel, J. G., and Hambrick, D. C. "Diversification Posture and the characteristics of the Top Management Team," *Academy of Management Journal* (35), 1992, pp. 9-37.

Miller, D., and Friesian, P. "Archetypes of Organizational Transition," *Administrative Science Quarterly* (25), 1980, pp. 268-299.

Murray, A. I. "Top Management Group Heterogeneity and Firm Performance," *Strategic Management Journal* (35), 1989, pp. 9-37.

Orlikowski, W. J. "The Duality of Technology: Rethinking the Concept of Technology in Organizations," *Organization Science* (3), 1992, pp. 398-427.

Orlikowski, W. J. and Robey, D. "Information Technology and Structuring of Organizations," *Information Systems Research* (2), 1991, pp. 143-169.

Osborn, A. F. *Applied Imagination*, Scribner's, New York, 1953.

Pelled, L. H. "Demographic, Diversity, Conflict, and Work Group Outcomes: Social Integration, and Turnovers," *Administrative Science Quarterly* (34), 1996, pp. 21-37.

Pinsonneault, A., and Kraemer, K. "The Impact of Technological Support of Groups: An Assessment of the Empirical Research," *Decision Support Systems* (5), 1989, pp. 197-216.

Pfeffer, J. "Organizational Demography," in *Research in Organizational Behavior*, L. L. Cummings and B. M. Staw (eds.), JAI Press, Greenwich, CT, 1983.

Russo, J. E., and Schoemaker, P. J. H. *Decision Traps*, Fireside, New York, 1989.

Robey, D. "Theories That Explain Contradiction: Accounting for the Contradictory Organizational Consequences of Information Technology," in *Proceedings of the Sixteenth International Conference on Information Systems*, J. I. DeGross, G. Ariav, C. Beath, R. Hoyer, and C. Kemerer (eds.), Amsterdam, December 1995, pp. 55-63.
Samuelson, B. A.; Galbraith, C. S.; and McGuire, J. W. "Organizational Performance and Top-Management Turnover," *Organizational Studies* (3), 1985, pp. 275-291.

Shaw, M. E. *Group Dynamics: The Psychology of Small Group Behavior*, 3rd ed., McGraw-Hill, New York, 1981.

Smith, K. G.; Smith, K. A.; Olian, J. D.; Sims Jr., H. P.; O'Bannon, D. P.; and Scully, J. A. "Top Management Team Demography and Processes: The Role of Social Integration and Communication," *Administrative Science Quarterly*, (39), 1995, pp. 412-438.

Tapscott, D., and Castone, A. *Paradigm Shift: The New Promise of Information Technology*, McGraw-Hill, New York, 1993.

Tushman, M. L., and Anderson, P. "Technological Discontinuities and Organizational Environments," *Administrative Science Quarterly*, (31), 1986, pp. 439-465.

Valacich, J. S.; Dennis, A. R.; and Connolly, T. "Idea Generation in Computer-Based Groups: A New Ending to an Old Story," *Organizational Behavior and Human Decision Process* (57), 1994, pp. 448-476.

Vancil, R. F. *Passing the Baton: Managing the Process of CEO Succession*, Harvard Business School Press, Boston, 1987.

Van Gundy, A. B. *Techniques of Structured Problem Solving*, Van Nostrand Reinhold, New York, 1981.

Winer, B. J. *Statistical Principles in Experimental Design*, 2nd ed., McGraw-Hill, New York, 1971.

Appendix

Formality in TMT Decision-Making Process

1. TMT meetings tend to be very formal in nature.
2. Meetings between members of the TMT are very informal (reverse coded).
3. Communication between members of the TMT is always in writing.
4. The TMT employs information rather than formal communication channels (reverse coded).