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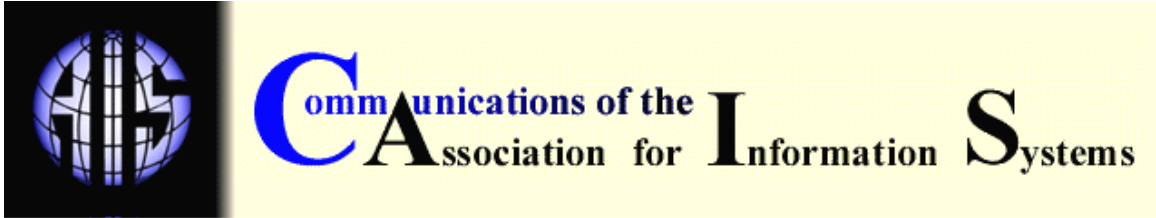
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THE BOARD OF DIRECTORS AND THE MANAGEMENT OF INFORMATION TECHNOLOGY

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ABSTRACT

While IS researchers studied the role of the CIO extensively, little work is reported on how CEOs and Boards of Director influence IT investments and the adoption of IT enabled strategies. This paper examines the association of board characteristics with IT investment decisions and the role of the CIO. Our research confirms that CEOs and boards of companies to date have limited IT experience. We find that younger boards, and those with more IT-experienced external board members are associated with larger IT investments and the presence and role of a CIO.

KEYWORDS: Board of directors, management of IT, IT investment

I. INTRODUCTION

The management of information technology (IT) is a significant challenge. Managers face decisions on how to structure the IT function (Sambamurthy and Zmud, 1999, Davenport et al., 1992), whether or not to appoint a CIO (Earl and Feeny, 1994), whether or not to outsource (Lacity and Hirschheim, 1993; Loh and Venkatraman, 1992), and how much to invest in information technology (Lucas, 1999). A number of resources assist senior managers in making these decisions, including the resources provided by the board of directors. To what extent does the board influence the management of information technology?

The purpose of this paper is to explore the influence of the board of directors on the management of information technology in the firm. The impact of IT, especially the Internet and electronic commerce, elevated technology to a topic of board concern. Technology impacted current business models, forcing traditional companies like Merrill Lynch to begin trading on the Internet. The technology is a force for rapid growth at companies like Schwab, whose market capitalization once exceeded that of Merrill. What is the role of the board of directors in responding to these challenges from technology? Recent events surrounding Enron and Global Crossing place boards in an increasingly visible position, and give them new responsibilities.

First we develop predictions about the board and IT based on past research about boards in general (Sections II and III). We present the result of an exploratory study, including

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surveys completed by 37 board chairmen, information from *Information Week*, and data from a number of sources about board members (Section IV and V). We conclude with a discussion of the results and their implications for corporate governance.

II. PAST RESEARCH

Most past research on board of directors was directed at topics unrelated to technology. For example,

- Mallette and Fowler (1992) looked at poison pills,
- Westphal (1998) studied CEO interpersonal influence and boards,
- Hill and Snell (1988) examined conflict between stockholders' and management's goals,
- Norburn (1986) examined boards in the UK,
- Stearns and Mizruchi (1993) found that the types of financial institutions represented on firms' boards were associated with the amounts and types of financing the firms obtained.
- Daily and Dalton (1994) examined governance structure and bankruptcy, while
- Zald (1969) looked at board resources.

How does a board link the organization to its environment? Pfeffer (1972) looked at the boards of 80 nonfinancial corporations and found that board size and composition were related to the organization's need to co-opt sectors of the environment. Pfeffer found that organizations deviating from a preferred structure for their board of directors were less profitable than companies that more closely resembled the preferred structure.

Pfeffer observed the role of boards as a link to the environment in a 1973 study of hospital boards of directors. He found that larger boards were needed to co-opt resources while a smaller board was more likely to focus on administration. Pfeffer hypothesized that hospital boards would have more manufacturing representatives in areas where manufacturing was important in the community and the same would be true for board members with a background in agriculture in agricultural communities.

Hambrick and Mason (1984) proposed a model to explain how the characteristics and background of top managers influence organizational performance. While this model focuses on top managers who are involved on a daily basis in the firm, we believe it has applicability to board members as well. The model links characteristics like functional background, other career experiences, and education to firm performance. Our study draws on Hambrick and Mason and includes many of the variables in their model. The variables in the Hambrick and Mason model are listed in Table 1, with the variable used in our study shown in italics.

Table 1. Variables in the Hambrick and Mason Model

<i>Age</i>	Socioeconomic roots
<i>Functional tracks</i>	Financial position
<i>Other career experiences</i>	<i>Group characteristics</i>
<i>Education</i>	<i>Tenure</i>

III. PREDICTIONS

Past research provides some theoretical and empirical background for understanding the potential role of the board of directors in managing information technology. The predictions below relate various characteristics of the board of directors to the firm's IT ranking, investment in IT, and to the presence and role of the CIO. We describe the measurement of each of these variables in the section on Research Design.

Pfeffer (1973) found that larger boards were associated with greater budget increases for hospitals. Large boards bring more resources to bear and are likely to have widespread experience, some of which might encompass technology. A large board should represent more customers and suppliers, and its members should have encountered more technology:

Prediction 1: Large companies will be positively associated with large boards; large boards will be positively associated with the firm's IT ranking, investment in IT, and with the presence and role of the CIO.

Researchers found that boards represent the important constituencies for a company. One role of the director is to remain aware of the external environment and bring resources to help the firm reach its goals. More highly educated board members should be able to play this role for technology better than other board members.

Prediction 2: Board members' educational levels will be positively associated with the firm's IT ranking, investment in IT, and with the presence and role of the CIO.

Stearns and Mizruchi (1993) found a relationship between board members from financial institutions and the type of financing the firm obtained. Their research suggests the existence of an association between board member background and the needs of the firm. While education in general prepares a board member to apply resources to manage the firm, a technical degree should prepare a board member to provide the most input on information technology.

Prediction 3: The percentage of technical degrees on the board will be positively associated with the firm's IT ranking, investment in IT, and with the presence and role of the CIO.

Work background influences an individual's approach to problems. Just as Pfeffer (1973) found that hospital boards in agricultural communities included more members from agriculture, a board with members whose background includes IT can be expected to pay more attention to information technology.

Prediction 4: Boards with more internal and external members with IT backgrounds will be positively associated with the firm's IT ranking, investment in IT, and with the presence and role of the CIO.

Information technology began to play a part in business only in the late 1950s, and the Internet for business is a 1990s phenomenon. Internet start-ups and the technology profession are often associated with younger as opposed to older managers. We predict that younger boards will be more aware of technology and more active in managing it:

Prediction 5: Younger boards will be positively associated with the firm's IT ranking, investment in IT, and with the presence and role of the CIO.

As Westphal (1998) demonstrated, the role of the chief executive officer (CEO) is an extremely important one in providing leadership to the organization and the board of directors. CEOs are often accused of hand-picking board members; whether or not this criticism is true, the CEO certainly approves a new board member when he or she joins. Boards tend to follow the leadership of the CEO until they lose confidence in him or her. As a result, one would expect the board to mirror some of the CEO's attitudes.

Prediction 6: The CEO's attitudes toward IT will be associated with the firm's IT ranking, investment in IT, and with the presence and role of the CIO.

IV. RESEARCH DESIGN

To test the predictions in Section III, we employed several data collection techniques and used a combination of primary and secondary data sources. The data collection occurred in 1997

and 1998 and is described in this section. We began with a list of 500 companies ranked by *Information Week*, based on survey conducted for the magazine by a firm named Computer Intelligence(CI). Computer Intelligence surveys corporations and collects between 300 and 400 data elements about each company site. CI assigns a score based on the number of users and the range of products in use. The score is biased toward large users; for example, a LAN with 500 users would have a higher score than one with 100 users. CI also factors in the extent to which a company uses leading-edge technology. The total score for a company consists of the sum of the scores of its individual sites.

The *Information Week* annual article on the top 500 companies in the use of IT also contains data on company revenues, income the IT budget, and the highest ranking IT executive. At the time we began this research, the 1996 ranking was available and it provided the list of firms to contact. The next step was to create a short questionnaire for the CEO of each company. The first part of the questionnaire asks about the existence of a CIO, the CIO's job, the time the CEO spends on IT issues, and the background of the board of directors. The second part of the survey asks for the CEO's opinions about information technology.

We mailed the survey with a cover letter to all CEOs on the *Information Week* 500 list. We followed up with a second letter and with phone calls. Despite this effort, extending well over six months, we received only 37 usable returns from the CEOs, or a response rate of a little over 7%. At this point, we had to decide whether to continue the study, or to abandon it due to the low response rate.

To make this decision, we compared IT budgets and firm revenues for a random sample of the companies on the *Information Week* 500 and the respondents. The analysis showed that differences in the two groups were not statistically significant; the probabilities associated with the t scores were all above .20. We also reviewed some past efforts in the literature at surveying CEOs and found similar, low response rates. Gulati and Westphal (1999) bemoan the low response rates for board surveys, while Vedder et al. (1999) experienced a 12.5% response rate in a survey of CIOs and CEOs.

Some of the 37 returns were from very well-known companies respected for their advanced technology. We decided that the data are interesting and that the analysis should proceed, but we caution the reader about problems with the response rate. The analysis employs non-parametric statistics because they make far fewer assumptions about the nature of the sample than their parametric counterparts.

The next step was to identify the boards of directors of the 37 responding firms and to collect data on their backgrounds. The average board included 11 members, and this research task turned out to be far more difficult than originally anticipated. Using EDGAR and 10K reports, and company profiles from Disclosure's SEC database, it was possible to find the names of board members.¹ Collecting data on backgrounds required accessing a variety of information sources, including direct contact with a responding company's investor relations office. The identity of some board members was easy to trace, but an individual listed in the 10K as "John Smith, Private Investor" posed a challenge. We consulted the following sources to obtain information on board members:

- *Hoovers Handbook of American Business*
- Hoovers Online
- *Standard and Poor's Register of Corporations, Directors and Executives*
- *Whos' Who in Finance and Industry*
- *Forbes CEO 1999, Corporate America's Most Powerful People*
- Proxy statements and Annual Reports from the company or EDGAR
- EDGAR database from the SEC
- Corporate Web sites.

¹ EDGAR provides Internet access to documents that public firms have to file with the SEC like the 10K, which is a comprehensive annual report of a company's business and financial condition.

CEOs completed the survey during 1997 and 1998; the board data was collected in 1998 and 1999. Thus, there is a small time period between the CEO responses and the board data. However, changes in boards occur slowly, and we do not believe that this lag is significant.

Table 2 presents the variables in the study, their source, and their mean value. The dependent variables include the Computer Intelligence (CI) rating, firm revenue, and IT budget from *Information Week*. We computed the IT budget as a percentage of revenue from these data. The CEO questionnaire provided information about the presence of a CIO, his or her length of service, and whether or not this individual was considered part of the senior management team. The CEO also indicated the size of an investment that needed board approval, and how often the board reviewed IT plans and performance.

Table 2. Variables in the Study

Variable	Source	Mean
Dependent		
CI Value (IT rating)	<i>Information Week</i>	15,365
IT Budget	<i>Information Week</i>	\$167,839,000
IT % of Revenue	Calculated	2.18%
Have CIO (0 or 1)	CEO Questionnaire	0.66
CIO tenure	CEO Questionnaire	3.77 years
CIO part of senior management (0,1)	CEO Questionnaire	0.41
Investment size board review	CEO Questionnaire	\$9,500,000
Frequency board review	CEO Questionnaire	1.56 times per year
Independent		
Firm revenue (mlions)	<i>Information Week</i>	\$6,357
No. internal board worked IT	CEO Questionnaire	0.46
Number internal board technical degrees	CEO Questionnaire	0.71
No. external board worked IT	CEO Questionnaire	1.12
No. external board technical degrees	CEO Questionnaire	2.88
Board % technical degree	Diverse sources	35%
Board % undergraduate degree only	Diverse sources	19%
Board % graduate degree	Diverse sources	60%
Average age board	Diverse sources	60 years
Board size	Diverse sources	11
IT enhances competition	CEO Questionnaire (alpha= .64)	5.92
Monitor IT	CEO Questionnaire (alpha= .65)	5.31
Threats from IT	CEO Questionnaire (alpha=.66)	4.17
Confidence in IT decisions	CEO Questionnaire (alpha=.87)	5.10

The independent variables include the CEO's response to questions about how many internal (company employee) board members have worked in IT and how many have technical degrees. The CEO provided the same information for external or independent board members. The data we collected on the identity of individual board members provided information about degrees and background to supplement the information from the CEO. We were unable to locate every board member, so the percentages are based on the number of board members actually located in the sources described above. We computed the percentage

of the board with a technical degree, with an undergraduate degree only, with a graduate degree, the size of the board and the average age of board members.

The last four variables are the CEO's response to the second part of the questionnaire on opinions about IT. We used correlation and factor analysis to create scaled variables from individual responses:

1. The first scaled variable consists of two questions about the role of IT in enhancing competition.
2. The second scale combines two questions about the extent to which the firm monitors new IT developments and its competitors' IT efforts.
3. The third scale consists of four questions that describe threats to existing business from IT, changes from technology and the need to be a technology leader.
4. The last scale consists of six items that describe the CEO's confidence in the firm's decisions about IT.

DESCRIPTION OF THE SAMPLE

Table 2 shows that the revenues of average firm in our sample was \$6.36 billion a year and its IT budget was nearly \$168 million. Sixty-six percent of the firms have a CIO, and the average CIO tenure is 3.8 years. Only 41% of the CEOs see the CIO as a part of their senior management team.

The average board in our sample consists of 11 members with an average age of 60. Very few internal board members (company employees) held technical degrees or had worked in IT. More external board members had worked in IT or held technical degrees, but these individuals are still a minority on the board. The average size of IT investment for board review is \$9.5 million, and the average number of IT reviews by the board is 1.56 a year.

OUTCOME VARIABLES

The mean values of the outcome variables are listed in Table 2. The predictions reference dependent variables that include the firm's IT ranking, investment in IT, and the presence and role of the CIO. The CI value represents an independent ranking of the quality of information technology efforts for each company in the study. We include the IT budget and IT budget as a percentage of revenue as an indication of a firm's investment in information technology. Is investing more in IT desirable? Do companies that spend a lot on IT do so because they invest poorly, or are they adept at taking advantage of what technology has to offer (Lucas, 1999)? Given the explosive growth of information technology, the new business models enabled by the Internet, and electronic commerce, investing in information technology is rapidly becoming a part of a firm's competitive strategy. For example, Merrill Lynch changed its business and revenue model as it moved to trading on the Internet; its investment in technology is a competitive necessity.

IT management literature recommends that firms appoint a senior manager or CIO who is in charge of information technology (Lucas, 2000), and prescribes how this individual can add value to the firm (Earl and Feeney, 1994). A longer CIO tenure is generally a positive sign, as is the CEO considering the CIO a part of the senior management team (Earl and Feeney, 1994). It is also good practice for the board of directors to review an IT investment beyond some level, and for the board to perform some kind of review of IT in general every year. Most boards use an investment cutoff; the board must explicitly approve projects that require a larger expenditure than the cutoff amount. A general IT review demonstrates the boards' interest in technology and provides the opportunity for the board to offer guidance on IT plans and directions.

V. RESULTS

BACKGROUND

Tables 3 through 5 present the results of the research. All of the financial measures in Table 3,

- the CI Value, IT budget,
- IT budget as a percentage of firm revenue, and
- firm revenue,

are correlated, and coefficients are statistically significant. As expected, the CI value is related to the IT budget and firm revenue. This last variable is a surrogate measure for firm size, and one would expect IT budgets to be correlated with firm size.

Table 3. Spearman Correlations Among Financial Variables

	CI value	IT budget	IT budget % Revenue	Revenue
CI value	–	.49*** (37)	.49*** (37)	.42*** (37)
IT budget		–	.53** (37)	.81*** (37)
IT budget % revenue			–	NA
Revenue				–

* $p \leq .10$; ** $p \leq .05$; *** $p \leq .01$ (n)

The non-financial dependent variables in Table 4 include

- whether or not there is a CIO,
- the tenure of the CIO,
- whether the CIO is on the senior management team,
- the IT project investment size for board review, and
- the frequency of the board's IT reviews.

Table 4. Spearman Correlations among Non-financial Dependent Variables

	Have CIO	CIO tenure	CIO on senior team	IT investment size	Frequency IT board review
Have CIO	–	-.24 (37)	.38** (37)	.66*** (25)	-.01 (25)
CIO tenure		–	-.13 (37)	-.32 (25)	-.08 (25)
CIO on senior team			–	.24 (25)	-.19 (25)
IT investment size				–	-.08 (20)
Frequency IT board review					–

* $p \leq .10$; ** $p \leq .05$; *** $p \leq .01$ (n)

Only two relationships are significant among these variables:

1. Between having a CIO and the presence of the CIO on the senior management team.
2. Having a CIO is associated with the size of investment the board reviews.

It is possible that the presence of a CIO results in a higher limit for board review. Another possibility is that large companies have both CIOs and higher review limits; the correlation between having a CIO and firm revenue is .33, significant at the 5% level.

TESTING THE PREDICTIONS

The earlier predictions provide a structure for presenting the results of the study. We tested the predictions by correlating dependent and independent variables (Table 5).

Prediction 1 is that larger firms will have bigger boards and that a larger board will be associated with IT rank, IT investment, and the presence and role of a CIO. Revenue is often used as a measure of firm size and we adopted it as an indicator of size for this study. The correlation of firm revenue and board size is .72 (significant at $<.01$); larger firms do have bigger boards. Firm revenue is also associated with the CI value, the absolute size of the IT budget, the presence of a CIO, and the size of IT investment requiring board approval. Board size is correlated with the IT budget, the IT budget as a percentage of revenue and the size of IT investment for board review. The first prediction receives considerable support from the data; large firms invest more heavily in IT and are likely to have a CIO to manage that investment when compared with smaller firms. In addition, larger companies have higher IT investment thresholds for board review.

Table 5. Spearman Correlation of Independent and Dependent Variables

	CI Value	IT Budget	IT Budget % revenue	Have CIO	CIO Tenure	CIO Senior Team	IT Investment Size	Frequency IT Review
Firm revenue	.42*** (37)	.82*** (37)	NA	.33** (37)	-.25 (36)	.00 (36)	.70*** (25)	.02 (24)
No. internal board worked in IT	.11 (35)	.17 (34)	.22 (34)	.00 (35)	-.20 (34)	.02 (34)	-.28 (23)	-.25 (22)
No. internal board technical degree	.06 (35)	-.05 (34)	.09 (34)	-.02 (35)	-.17 (34)	.23 (34)	-.38* (24)	-.61*** (22)
No. external board worked IT	.37** (33)	.53*** (32)	.33* (32)	.32* (33)	-.14 (32)	.50*** (32)	.23 (22)	-.38* (20)
No external board technical degree	.01 (33)	.14 (32)	.06 (32)	.15 (33)	-.34* (32)	.38** (32)	.26 (23)	-.59*** (21)
% board technical degree	.09 (33)	-.08 (33)	.10 (33)	.47*** (33)	-.17 (32)	.34* (32)	.11 (22)	-.06 (21)
% board only one degree	.04 (33)	.42** (33)	.43 (33)	.12 (33)	-.02 (32)	.01 (32)	.01 (22)	.66*** (21)
% board graduate degree	.02 (33)	.30* (33)	.34* (33)	-.05 (33)	.28 (32)	-.11 (32)	.09 (22)	-.06 (21)
Board age	-.07 (33)	.16 (33)	.15 (33)	-.38** (33)	.14 (32)	-.44*** (32)	-.04 (22)	.20 (21)
Board size	.27 (34)	.74*** (34)	.51*** (34)	.23 (34)	-.13 (33)	.10 (33)	.69*** (22)	.08 (21)
IT enhances competition	.12 (37)	.26 (36)	.01 (36)	.13 (37)	-.11 (36)	.10 (36)	-.01 (24)	.38* (25)
Monitor IT	.44*** (37)	.53*** (36)	.20 (36)	-.05 (37)	-.08 (36)	.15 (36)	.30 (24)	.11 (25)
IT a threat	.40** (37)	.45*** (36)	.45*** (36)	-.07 (37)	-.21 (36)	-.04 (36)	-.05 (24)	-.45** (25)
Confidence IT decision	.10 (37)	.10 (36)	.13 (36)	.00 (37)	-.01 (36)	.22 (36)	-.12 (24)	.30 (25)

* $p \leq .10$; ** $p \leq .05$; *** $p \leq .01$ (n)

The second and third predictions relate board education levels and technical degrees with IT rank, IT investment, and the presence and role of a CIO. The percentage of the board holding technical degrees is correlated with a CIO and the CIO being a part of the senior management team. The percentage of the board with one degree and with graduate degrees is correlated with the IT budget; graduate degrees also are associated with the IT budget as a percentage of revenue. Holding one degree is associated with more frequent board reviews of

information technology. There is some support for predictions 2 and 3. Board members with more education and those with technical degrees appear able to bring resources to bear on technology.

Prediction 4 suggests that the background of the board in terms of work experience is important in predicting IT outcomes. The number of internal board members who worked in IT is correlated with the size of the IT investment requiring board review and the frequency of board review of IT efforts in the firm. The number of external board members who worked in IT is highly correlated with the dependent variables; the association is positive for CI value, IT budget, IT budget as a percent of revenue, a CIO, a CIO as a part of the senior management team, and the frequency of IT review by the board. The prediction that a board member's own work history focuses his or her attention on information technology is strongly supported. This finding is clearly stronger for external or independent board members than for internal board members.

Prediction 5 suggests that younger boards will be associated with more favorable IT outcomes; we found a strong, negative correlation between the average age of the board and having a CIO. The correlation between average age and having the CIO as a part of the senior management team is also negative. These results support the prediction; younger board members are more likely to encounter technology themselves, and to be aware of the need to manage it in the firm.

Prediction 6 suggests that CEO attitudes and opinions are important in predicting IT outcomes in the firm. The association between CI value and IT budget and the CEO's rating of the extent to which the company monitors IT developments is positive. The strongest findings are for the CEO's rating of the threat from IT; it is positively associated with CI value, IT budget, IT budget as a percentage of revenue, and negatively correlated with the frequency of board review of IT. It is possible that CEOs who see a threat from technology spend more time on it in defense, or that firms spending more on IT are aware of possible threats from the technology. Under either scenario, the CEO is sufficiently active that the board does not review IT efforts frequently.

Table 6 presents a summary of the results of the study.

Table 6. Summary of Results

PREDICTION	SUPPORT
1. Large companies associated with large boards, IT ranking, IT investment, CIO	Considerable support from the data
2. Board education and 3. technical degrees associated with IT ranking, investment and CIO	Some support for association between technical degree and IT rank, investment and CIO. One degree and graduate degree associated with IT budgets
4. More members with IT backgrounds associated with IT ranking, IT investment and CIO	Very strong support for association between external board members in IT and dependent variables
5. Younger boards associated with IT ranking, IT investment and CIO	Strong relationship between younger board and CIO
6. CEO's attitude associated with IT ranking, IT investment and CIO	Strongest findings on threat from IT

CEO ON THE CIO

The questionnaire contained four open-ended questions asking the CEO to indicate the most important qualities of a successful CIO. The degree of consensus among the CEOs responding was remarkable. A significant number stressed understanding the business, technology, and user needs as key CIO skills. A number mentioned attributes related to vision and strategic thinking: the CIO needs to be creative. A final category of comments revolved

around managing people. The CIO should have good interpersonal and communications skills, and should be adept at team building and project management. The CEOs feel that the CIO needs to be a leader. We might speculate that whether or not a CIO possesses these characteristics influences the likelihood that he or she will be a member of the senior management team.

VI. DISCUSSION

In general, the predictions about the relationship between boards of directors and information technology management and outcome variables are supported. Our results suggest that there is an association between the characteristics of the board of directors, IT rank, IT investments, and the presence and role of a CIO. However, the reader is cautioned to consider the small response rate and sample size in generalizing from this study. In addition, we collected the data during the 1997-98 time period when firms were making large investments in information technology. The results do not reflect the downturn in the economy of 2001-2002.

We should also note that the study found associations; the research design does not allow us to draw causal inferences. The mechanism that is responsible for these associations is not clear. For example, it is possible that all the findings are a result of size: large firms spend more on IT, have a CIO, and so on. Partial correlation analysis controlling for size does not support this reasoning. Another path leading to these findings is that large companies have larger boards, and with a larger board one is likely to find more diversity and board members with prior IT experience. These board members take an interest in information technology and encourage the board to see that there is a CIO and to review IT plans. For now, an explanation for what caused the associations we observed must await further research.

The results do show a relationship among firm revenue (size), board size, and IT ranking, supporting the popular belief that large companies in general allocate more resources to information technology. However, it is easy for a large firm to become complacent and isolated from its environment. Full service brokers scrambled to catch up with e-brokers on the Internet who were successful in attracting 28% of retail stock trades in the U.S. Would boards at full service brokerages with external members with a technology background have pressured management to act before online brokers eroded their market share?

Our research suggests that the answer to this question is "yes." The strongest finding from this study is the association between external board members who have some experience working with IT and outcome measures. These external board members serve as a link to the environment, bringing their knowledge of technology and available resources to the board and the firm. The SEC has long called for more external board members, though their motivation is to provide an independent check on company management. Past research on boards (Section II) and the findings of this study suggest an important role for external board members: they are a link to a highly uncertain environment and provide resources for management based on their experience. Companies confront a changing business environment, due largely to information technology and the Internet. Under these conditions, external board members play a significant role in linking the board and senior management to new technologies.

A college degree, a graduate degree and a technical degree are all associated with the outcome variables in this study. Education helps board members become aware of important trends in the environment and to locate resources for the firm to deal with these trends. Information technology over the last decade is a trend that impacts every firm; an educated board is prepared to consider issues of IT management.

The CEO's attitudes and opinions are also related to the firm's IT rank and budget, especially his or her concern over the threats from technology. It is also usually the CEO who decides if the firm will have a CIO, and whether or not this executive will be a part of the senior management team.

This study suggests a profile for a board that is associated with IT investments and management practices. Compared with other boards, this IT-oriented board includes younger board members and a large concentration of external or independent members. Some of these external members hold technical degrees and worked in technology at some point in their careers. The board is relatively large to accommodate both external and internal members. The

board encourages the creation of a CIO position, and suggests that this person be a member of the senior management team. IT investments above a certain level must come before the board for discussion and approval; the board periodically reviews IT plans and performance.

The results of this study suggest that senior management should view the board of directors as another resource for managing IT and creating positive IT outcomes. A board does not need to become involved in detailed daily management of technology, its primary role is making company management aware of technological trends in the external environment and the resources technology can provide the firm. The board should also help the firm integrate IT with its competitive strategy. As technology increasingly impacts strategy and threatens existing business models, this role may turn out to be one of the board's most important contribution to shareholders and the firm.

Editor's Note: This article was received on April 8, 2002 and was published on May 6, 2002. This paper deals with a subject of importance to the IS field: the role of the board of directors in making decisions about IT. This paper is a "first paper" that opens an important question for consideration by IS researchers. Like most first papers, it is not a rigorous study that draws heavily on existing literature.

The history of this paper is as follows: It was originally submitted to another journal in 2000. The journal did not respond for two years and then returned the paper without comment, a delay that occurs much too often in our field. The authors then submitted the paper to CAIS. Rather than burying a unique study because of the age of the data, I sent the paper to an Associate Editor. On the associate editor's recommendation that the paper is a contribution, I decided that it merits publication in CAIS.

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