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## The Value Relevance Of Announcements Of Transformational Information Technology Investments

Bruce Dehning

*Chapman University*, [bdehning@chapman.edu](mailto:bdehning@chapman.edu)

Vernon J. Richardson

*University of Kansas*

Robert W. Zmud

*University of Oklahoma*

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# The Value Relevance Of Announcements Of Transformational Information Technology Investments

## Comments

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Management Information Systems Research Center, Carlson School of Management, University of Minnesota

## THE VALUE RELEVANCE OF ANNOUNCEMENTS OF TRANSFORMATIONAL INFORMATION TECHNOLOGY INVESTMENTS<sup>1</sup>

By: Bruce Dehning  
Argyros School of Business  
and Economics  
Chapman University  
Orange, CA 92866  
U.S.A.  
bdehning@chapman.edu

Vernon J. Richardson  
School of Business  
University of Kansas  
Lawrence, KS 66056-3004  
U.S.A.  
vrichardson@ku.edu

Robert W. Zmud  
Michael F. Price College of Business  
University of Oklahoma  
Norman, OK 73019  
U.S.A.  
rzmud@ou.edu

### Abstract

*In this paper, we examine the influence of IT strategic role to extend the findings of Im et al. (2001), Chatterjee et al. (2002) and Dos Santos et al. (1993). Specifically, we demonstrate that IT strategic role can explain how IT investments in each of the IT strategic roles might affect the firm's competitive position and ultimately firm value. We find positive, abnormal returns to announcements of IT investments by firms making transformative IT investments, and with membership in industries with transform IT strategic roles. The results of previous research are not found to be significant when IT strategic role is included as an explanatory variable. These results provide support for the value of capturing the IT strategic role of a firm's IT-related competitive maneuvering in studies striving to understand the conditions under which IT investments are likely to produce out-of-the-ordinary, positive returns.*

**Keywords:** IT investment, event study, IT strategic role, stock market reaction

### Introduction

Do investments in information technology (IT) pay off? Increasingly, the evidence suggests the

<sup>1</sup>V. Sambamurthy was the accepting senior editor for this paper.

answer is yes, but only when the IT investment scenario is well targeted, well timed, and accompanied with complementary investments and actions (Barua and Mukhopadhyay 2000). The salient question, then, is not "Do investments in IT pay off?" but rather "Under what conditions do investments in IT pay off?" This paper seeks to add to our collective understanding of this rephrased research question. Through the use of event study methodology and careful research design, it is possible to assess the extent to which attributes of IT investments, investing firms, and/or investment contexts influence shareholders' interpretation of the value relevance of such announcements and, as a consequence, produce abnormal movements in the investing firm's stock price.

Previous research examining the value relevance of announcements of IT investments has produced intriguing results (Dos Santos et al. 1993; Im et al. 2001). However, they fail to produce a general understanding of the conditions under which IT investments are likely to produce positive returns. We extend earlier work by proposing an overarching construct, IT strategic role, that accounts for factors previously found to affect the stock market response to IT announcements and provides for a more robust understanding of the conditions that lead investors to positively value an IT investment. First, we briefly review prior studies regarding IT investment announcements, and then we elaborate on the influence of IT strategic role in investors' appraisals of IT investments. We follow that by proposing an empirical model and test the relation between IT strategic role and firm value. We conclude with a discussion of our results.

## Previous, Related Event Studies of IT Investment Announcements

Dos Santos et al. (1993) examine the stock price reaction to IT investment announcements in the context of two explanatory variables, industry and

innovation. The industry variable (financial firms versus manufacturing firms) is expected to have a significant effect because IT is proposed to have a larger impact on financial firms than non-financial firms due to the information intensity of the financial industry. The innovation variable captures the effect of being the first to use a new technology or to introduce a new technology-enabled product or service. As argued, firms introducing innovative IT initiatives are likely to experience increases in profitability until the initiative becomes routine, i.e., a competitive necessity, within the industry. While Dos Santos et al. did not find any significant effects for financial firms, they did find that innovative IT investments were related to positive, abnormal stock price returns.

Im et al. (2001) examine the stock price reaction to IT investment announcements in the context of three explanatory variables: industry, size, and time period. Consistent with Dos Santos et al., the industry variable (financial versus non-financial) serves as a proxy for industry-level information intensity. Regarding firm size, Im et al. argue that smaller firms are more likely to have certain advantages when information is considered an asset and complete contracting is not possible (Brynjolfsson 1994). We expect firm size to be related to abnormal returns for two additional reasons. First, competitive advantage is likely to be more sustainable for small firms as it is more difficult for other firms to be aware of the actions of small firms vis-à-vis large firms (Feeny and Ives 1991), i.e., the smaller firms are, the less likely they are to undergo scrutiny and be viewed as a threat by larger firms in the industry. Second, firm size proxies for the information set available to investors prior to the IT investment announcement, and the announcements for small firms contain more news than those for large firms (Atiase 1985). Im et al. introduce the third variable, time period, in order to account for the time lag between when IT investments are made and when the benefits show up in financial statements. While this is a relevant argument when using accounting performance measures, it is not relevant when using market measures as investors take into account future performance impacts at the time of an announcement. How-

ever, other arguments can be raised for the salience of a time effect: a maturing of a firm's understanding of IT, a maturing of a firm's IT infrastructure and IT application portfolio, and a greater likelihood that complementary investments have been made. Subsequent analysis showed that abnormal returns to IT investment announcements were, in fact, related to firm size, time period, and financial/non-financial industry.

Very recently, Chatterjee et al. (2002) undertook a study of 112 IT investment announcements between 1992 and 1995 to assess a proposition that an important condition that underlay investors' appreciation of IT investments is the targeting of a firm's IT infrastructure rather than IT applications. Chatterjee et al. (2002) argue that IT infrastructure investments will induce a positive, abnormal marketplace reaction because of the broader scope of such investments and their option-like characteristics, i.e., they introduce robust technology platforms that can be leveraged by a variety of current and future IT applications. Support for these ideas was confirmed in the ensuing empirical analyses.

## Hypotheses Development

It is argued that the primary signals to which investors react regarding IT investment announcements are the expected marketplace impact targeted by the IT investment and the dominant role served by IT across the firms competing in an industry. Both of these conditions evolve from the IT strategic role construct, conceptualized by Schein (1992) and Zuboff (1988) as:

- Automate, i.e., replacing human labor in automating business processes
- Informate-up, i.e., provide information about business activities to senior management
- Informate-down, i.e., provide information about business activities to employees across the firm

- Transform, i.e., fundamentally redefine business and industry processes and relationships

It is important to note that IT strategic role operates at both the firm and industry-level. Prior research has applied the IT strategic role construct both at a firm level, e.g., Armstrong and Sambamurthy (1999), and at an industry-level, e.g., Chatterjee et al. (2001). We examine the reaction to IT investment announcements by accounting for the targeted strategic role of the announced IT investment, the dominant industry IT strategic role for the industry of which the announcing firm is a member, and the interactive effect between these two variables. Note, however, that when a company announces an IT investment, this investment's strategic role may very well be distinct from the firm's overall IT strategic role (which we do not measure). Below, the relationship between these IT strategic roles and firm value is discussed.

### **Strategic Role of an IT Investment**

Companies that use IT to *automate* human labor generally invest in IT in order to improve the efficiency of existing business processes. There are two reasons why automate IT investments are not expected to produce large increases in profits or value. First, it has proven extremely difficult for firms to sustain competitive advantages gained through IT investments (Clemons and Row 1991). Unless the IT-enabled investment is extremely difficult to duplicate (i.e., involves scarce resources, is dependent on a series of antecedent investments, involves unique qualities of an organization's culture or capabilities, etc.), competitors will quickly implement comparable initiatives and allay any relative competitive advantage. Thus, accruing benefits tend to be very short-lived. Second, when such IT practices come to dominate an industry, these IT investments are best referred to as competitive necessities. Rather than providing a firm with a competitive

advantage, the IT-enabled initiatives enable a firm to continue as an active industry participant, at best maintaining the current level of profitability. In such situations, firm profits may actually decrease as competitive dynamics eventually drive any accruing benefits to consumers rather than to industry participants (Hitt and Brynjolfsson 1996).

*Informatize-up* and *informatize-down*, considered together here, involve the use of IT to induce decision-making and decision-taking at, respectively, higher and lower organizational levels. When implemented well, these IT investments do possess the potential to enhance competitiveness through improvements in the effectiveness of existing business processes. However, as with automate IT-enabled initiatives, informatize initiatives typically provide short-term improvements in firms' performance, given the speed with which competitors are able to implement imitable applications.<sup>2</sup> Again, any increases in profitability are likely to be short-lived and, as the informatize mode comes to characterize an industry's IT-related activities, profits might actually decrease, as consumer surplus goes to consumers rather than industry members.

It may very well be possible for firms to invest in an enhanced informatize mode and to experience an increase in profits. Similarly, it may very well be possible for all the firms in an industry in which the informatize IT strategic role dominates to experience a collective increase in profits. In both situations, what has likely occurred is that the IT-enabled initiatives are accompanied by complementary changes in firms' decision structures and cultures such that decisions being made are radically better (due to more and more current information across the value chain) and radically quicker (due to elimination of information pro-

cessing and/or decision steps), thus producing structural changes within existing firm and/or industry practices. Because of the complexities and difficulties involved in introducing and maintaining radical transformations of a firm's decision structure and culture, such IT-enabled initiatives are sustainable (producing a continuing competitive advantage) for the subset of industry participants who have successfully transitioned to this new set of industry practices. Because they are able to extract a premium return from their business activities, this subset of firms (and for only this select subgroup of industry participants) has repositioned to a higher level of sustained profitability. We argue that this form of an informatize IT investment actually reflects the transform IT strategic role, described more fully below.

Companies that use IT in a *transform* IT strategic role introduce radical business models that disrupt industry practices (e.g., bypassing select value chain participants) and market structures (e.g., creation of new market spaces) as a means to position themselves more favorably within an industry. The intended market changes are disruptive rather than incremental, and hence promise high, sustainable returns if successful. Often, however, such innovations prove unsuccessful (Weill 1992) because of associated complexities and uncertainties, thus producing a high-risk, high-return investment scenario.

Given the above discussion, we would expect that firms announcing transformational IT investments are more likely to experience positive, abnormal stock market returns than announcements of firms making non-transformational investments. The announcement of a transformational IT investment thus becomes a strong signal of a firm's expected differential performance relative to other firms. This leads to our first hypothesis:

***H1: Firms announcing IT investments characterized as reflecting a transform IT strategic role will experience positive, abnormal changes in market value.***

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<sup>2</sup>While informatize IT investments normally follow earlier investments that capture and store data and that interconnect an organization's data and IT resources, these earlier investments normally reflect automate IT initiatives.

## **Industry IT Strategic Role**

The industry IT strategic role construct is thought to capture, in an elegant manner, the leveragability of the industry context within which a major IT investment is directed. The construct's salience to the investment context has been demonstrated by Chatterjee et al. (2001), whereby announcements by firms of newly created CIO positions (investments in a firm's IT governance structure) produced positive abnormal changes in firms' stock prices only in industries characterized as exhibiting a transform IT strategic role. Chan et al. (1990) and Doukas and Switzer (1992) report evidence of firm valuation outcomes in a related research arena, research and development (R&D) investment. In those studies, statistically significant R&D announcement day returns were observed only for firms in R&D-intensive industries, i.e., those devoting substantial resources to R&D.

An investment cannot take place in isolation from the milieu of enacted business strategies and institutional structures comprising the marketplace, or industry, in which the investment occurs. Correspondingly, investors interpreting a firm's announcement of an IT investment are likely to do so through a lens reflecting the role that IT serves within the industry and, hence, the associated likelihood that IT investments will produce sustainable increases in industry profitability. Such an industry-focused lens is seen as particularly critical for the value relevance of IT investments, given both the relative ease with which competitors are generally able to react to IT-based strategic actions and the high uncertainty generally associated with IT investments targeted at inducing structural changes in industry practices and markets.

When the transform mode comes to dominate an industry, the structural changes taking place regarding value chains and market spaces essentially partition the industry's members into a set of strategic groups, with each strategic group reflecting a unique competitive strategy and oper-

ating at a differential profitability level. Note that even when the transform IT strategic role dominates within an industry, not all firms in the industry will be engaged in higher risk, transformational IT investment initiatives. Invariably, we argue, the profit levels of these strategic groups are associated with each strategic group's capability to successfully implement these transformational IT initiatives (which, along with other strategic investments, enable the strategic group's unique competitive posture). Note further that we are not attempting to characterize the nature of these individual strategic groups; transformational IT investments can enable and support a myriad of strategic actions. Most important, we argue further that the industry as a whole is able to operate at elevated profit levels relative to all other industries. Where does this elevated profitability come from? Three sources seem most likely: from under-performing strategic groups within the industry, from overall industry market growth, and from the industry's penetration of other industries' markets. Announcing an IT investment within an industry undergoing IT-enabled transformation is, in essence, an act of declaring or reinforcing membership in one or more of these strategic groups with elevated profit levels. The market will react, then, based on the differentiated profit level of the industry and the likelihood that the company will successfully transform to realize the benefits from IT.

It is thus posited that announced IT investments within industries in which the transform IT strategic role dominates are seen by investors as signals of either a future increase in the average or normal level of industry profitability or of the investing firm's entry to more profitable segments of the industry and, hence, likely to produce a positive increase in firm value. This discussion leads to our second hypothesis:

***H2: Firms announcing IT investments in industries in which the transform IT strategic role dominates will experience positive, abnormal changes in market value.***

## **Joint Consideration of Investment-Level and Industry-Level IT Strategic Role**

In addition to considering the influence of investment-level and industry-level IT strategic roles, it is important to recognize that differential effects may be realized when a firm's strategic intent with regard to an IT investment is viewed from the prevailing IT strategic role of that firm's industry. However, we do not believe that such a joint effect will be reflective of a multiplier effect, i.e., that an announcement of a transform IT investment within a transform industry would promote a supernormal influence on a firm's stock price. If an industry is in transform mode, investors would expect to observe transform investment announcements from firms in the industry. Instead, what might promote an abnormal (in this case, negative) reaction by investors would be announcements by firms in a transform industry of automate or informate IT investments. More specifically, we argue that a salient interactive effect arises when the nature (automate or informate) of a firm's IT investment is distinct from, i.e., leads or lags, the dominant industry IT strategic role. Following again a logic that investors interpreting firms' IT investment announcements will do so through a lens reflecting industry IT strategic role, we offer two additional research hypotheses:

**H3: Firms announcing IT investments that lead their industry IT strategic role will experience positive, abnormal changes in market value.**

**H4: Firms announcing IT investments that lag their industry IT strategic role will experience negative, abnormal changes in market value.**

## **Research Methodology**

The objective of this empirical analysis is twofold: to examine the influence of IT strategic role in

explaining the wealth effects accompanying announcements of IT investments, and to contrast the influence of IT strategic role relative to those of other variables previously used to explain the wealth effects of IT investment announcements (Im et al. 2001). In this section, the data set created for the analysis and the estimation method are described.

Compilation of the study's data set began with the sample of 97 IT investment announcements occurring from 1981 through 1988 that were identified by Dos Santos et al. (1993). Next, the sample of 141 IT investment announcements gathered by Im et al. (2001) over the time period 1989 through 1996 was added. Finally, the 112 IT investment announcements from Chatterjee et al. (2002) gathered from 1992 through 1995 were also used. All duplicates among the three samples were removed resulting in a total of 355 IT investment announcements during the period 1981 through 1996.<sup>3</sup>

The industry IT strategic role coding applied was that gathered and used by Chatterjee et al. (2001). Here, the instrument provided as Appendix A was designed and sent to four well-recognized scholars who both research and teach in the area of IT strategy. Each judge was asked to indicate whether the role that IT served within an industry in that specific time period would best be represented as automate, informate (up or down), or transform. Inter-rater reliability was 0.80 for the time period 1987 through 1994 and 0.82 for the time period 1995 through 1998. A mode value for the level of IT-driven transformation was computed and assigned to each industry.

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<sup>3</sup>In addition, we also removed two announcements (outliers with highly positive abnormal returns) from the data set analyzed by Im et al. (2001) due to contamination effects from other announcements not related to the IT investment announcement (in one case, a positive quarterly earnings report the day after the IT investment announcement; in the other case, a cost-reduction/restructuring initiative the same day as the IT investment announcement), resulting in a final dataset of 353 announcements.



The measure of IT strategic role at the industry-level commenced with the 1987 time period. For the sake of completeness and our wish to consider all available IT investment announcements, the level of IT-enabled transformation from 1987 through 1993 was applied to the earlier 1981 through 1986 period. While it is possible that the level of IT-enabled transformation across these industries would be different for the 1981 through 1986 period, any bias present would be expected to work against finding significant support for the research hypotheses.<sup>4</sup>

In order to categorize IT strategic role at an investment level, each IT investment announcement was carefully read to assess the firm's intended IT strategic role and coded as automate, informate, or transform by two judges (both authors of this paper). The coding rules used are provided in Appendix B, and Appendix C provides one example each of automate, informate, and transform IT investment announcements. Interrater reliability was 0.83, with all differences reconciled between the judges. The impact of announcements on stock prices is computed using event study methodology commonly utilized in accounting and finance studies (Brown and Warner 1985) and increasingly common in IS event studies (Subramani and Walden 2001). The estimation method and days in the estimation period are identical to Chatterjee et al. (2001).

## Results

Table 1 provides statistics regarding the number of announcements per year. A cross-tabulation of the investment-level and industry-level IT strategic role associated with each announcement is presented in Table 2.

<sup>4</sup>As a test of sensitivity, only those IT investment announcements for 1987 through 1996 (omitting those before 1987) were examined, producing essentially the same results.

## General Linear Model Results

A general linear model (GLM) was used to test if the mean cumulative abnormal return (CAR) for each type of IT strategic role was different from zero when additional factors are included in the analysis. In this GLM formulation, the dependent variable is the three-day CAR around the date of the IT investment announcement (day -1, 0, +1). Investment and industry IT strategic role were random factors in the model, with two dummy variables representing the three nominal groups within the IT investment strategic role classification and two dummy variables representing the three nominal groups within the industry IT strategic role classification. This coding does not presume an interval scale for the three distinct types of roles. Control variables in the model are the size of the announcing firm (total assets in the year of the IT investment announcement), time (number of days from the first IT investment announcement in the full sample to the date of each announcement), and a dummy variable denoting those announcing firms that are in financial industries were added as covariates.<sup>5</sup> The results of the GLM analysis can be found in Tables 3 and 4.

Table 3 reports the mean CAR for the overall main effects for investment and industry IT strategic role. The first hypothesis states that firms making IT investment announcements characterized as a transform IT strategic role will realize an abnormal increase in value. This is captured by the IT investment strategic role main effect. The only IT investment strategic role with a mean CAR significantly different from zero is a transform strategic role (CAR = 1.512%,  $p < .01$ ), supporting hypothesis one. The second hypothesis states that firms making IT investment announcements within an industry characterized as having a trans-

<sup>5</sup>We do not include the innovativeness measure of IT investment measure used by Dos Santos et al. (1993) or the IT infrastructure measure of Chatterjee et al. (2001). The innovativeness variable is highly correlated with industry transformation strategic role. After removing the two contaminated announcements (see footnote 3), the IT infrastructure variable was not a significant predictor of CAR.

**Table 1. Descriptive Statistics 1981– 1996: Number of IT Investment Announcements by Year (N = 353)**

Year	Number	Year	Number
1981	1	1990	22
1982	6	1991	17
1983	2	1992	33
1984	3	1993	45
1985	32	1994	46
1986	17	1995	48
1987	18	1996	20
1988	18	Total	353
1989	25		

**Table 2. Descriptive Statistics 1981– 1996: Cross-Tabulation of Announcements by IT Strategic Role (N = 353)**

Industry IT Strategic Role	IT Investment Strategic Role				Totals
	Automate	Informat	Transform	N/A*	
Automate	N = 112	N = 56	N = 17	N = 25	N = 210
Informat	N = 41	N = 27	N = 18	N = 9	N = 95
Transform	N = 19	N = 12	N = 13	N = 4	N = 48
Totals	N = 172	N = 95	N = 48	N = 38	N = 353

\*Insufficient information to code the announcement—either the announcement was missing or did not give enough information about the nature of the IT investment.

**Table 3. General Linear Model Results: Main Effects**

Mean CAR <sup>a</sup>		
IT Investment Strategic Role <sup>b</sup>		
Automate	Informat	Transform
0.051%	0.403%	<b>1.512%</b>
Industry IT Strategic Role		
Automate	Informat	Transform
0.003%	0.557%	<b>1.405%</b>

Values in **bold** are significant at  $p < .01$ .

<sup>a</sup>Three-day (days -1, 0, and +1) cumulative abnormal returns (CAR) controlling for size, time, and financial/non-financial firm distinction, 1981–1996,  $N = 353$ .

<sup>b</sup>The 38 announcements with a missing IT investment strategic role were assigned the industry IT strategic role as IT investment strategic role for this analysis.

Table 4. General Linear Model Results: Interactive Effects

Mean CAR			
Industry IT Strategic Role	IT Investment Strategic Role		
	Automate	Informat	Transform
Automate	-0.361%	-0.703%	1.074%
Informat	0.235%	0.250%	1.186%
Transform	0.278%	<b>1.661%*</b>	<b>2.277%**</b>

\*[\*\*] significant at the .05 [.01] level (one-tailed tests of significance)  
 Values in **bold** are significant at  $p < .05$

form dominant IT strategic role will realize an abnormal increase in value. This is captured by the industry IT strategic role main effect. The only industry IT strategic role with a mean CAR significantly different from zero is a transform strategic role (CAR = 1.405%,  $p < .01$ ), supporting hypothesis two.

The GLM also allows tests of combinations of investment and industry IT strategic roles. Table 4 reports a cross-tabulation of investment and industry IT strategic role. These tests specify whether the abnormal returns are different from zero for specific levels of IT investment strategic role (automate, informat, or transform) at specific levels of industry strategic role (automate, informat, or transform). Four of these combinations result in CARs of greater than 1 percent: when the IT investment strategic role is transform and the industry IT strategic role is automate, informat, or transform, and when the IT investment strategic role is informat and the industry IT strategic role is transform. Possibly due to the limited power of these tests, only two of these combinations result in abnormal returns significantly greater than zero. The first is an IT investment announcement that specifies an informat strategic role for the investment at a time when the industry strategic role is transform (mean CAR = 1.661%,  $p < .05$ ). The second is an IT investment announcement that specifies a transform strategic role for the investment at a time when the industry strategic role is transform (mean CAR = 2.277%,  $p < .01$ ). Mean CARs were not significantly different from zero for any other combinations of investment and industry IT stra-

tegic role. These results lend further support for hypotheses one and two, which argue for the salience of the transform industry strategic role (i.e., positive abnormal returns are observed for both informat and transform IT investments) and for transform IT investments. Further, these results also suggest that firms announcing an informat IT investment within an industry characterized by a transform industry IT strategic role are not penalized for this lagging investment.

### Multiple Regression Results

In order to directly examine the lead (hypothesis 3) and lag (hypothesis 4) effects as well as to explicitly contrast the effects of the IT strategic role variables relative to the effects of the variables examined by Im et al. (2001), multiple regression analysis was performed. Results are provided in Table 5. Here, the dependent variable is the three-day CAR around the date of the IT investment announcement. Three models were specified. In model 1, we examine industry-level and investment-level IT strategic role as main effects only. In model 2, we examine an industry-level main effect and then account for investment-level IT strategic role via a lead (IT investment strategic role transforms or *leads* industry IT strategic role) and lag (IT investment strategic role *lags* industry IT strategic role) dummy. In model 3, we examine the two main effects along with an interaction (i.e., multiplier) effect. In order to account for the Im et al. predictors, we also include size of the announcing firm, time, and a financial dummy variable as in the GLM analysis.

**Table 5. Regressing IT Investment Announcement Excess Returns<sup>a</sup> on IT Strategic Role, Year of Announcement, and Industry Variables**

Variable	Model 1	Model 2	Model 3
<b>Intercept</b>	-0.003 <sup>b</sup> -0.576 <sup>c</sup>	-0.005 -0.833	0.003 -0.582
<b>Assets</b>	-0.053 -0.874	-0.032 -0.532	-0.052 -0.866
<b>Time</b>	0.023 0.393	0.003 0.056	0.023 0.390
<b>Financial Firm</b>	0.004 0.061	0.022 0.347	0.004 0.063
<b>Transform Industry IT Strategic Role</b>	0.120 2.121*	0.107 1.713**	0.125 1.934*
<b>Transform IT Investment Strategic Role</b>	0.138 2.545*		0.142 2.299*
<b>Investment Leads Industry</b>		0.170 2.782**	
<b>Investment Lags Industry</b>		0.067 1.009	
<b>Transform Industry IT Strategic Role × Transform IT Investment Strategic Role Interaction</b>			-0.009 -0.134
<b>Adjusted R<sup>2</sup></b>	0.032	0.033	0.029
<b>F-Statistic</b>	3.34**	2.99*	2.77*
<b>N</b>	353	353	353

<sup>a</sup>Standardized coefficient<sup>b</sup>t-statistic

\*p &lt; .05; \*\*p &lt; .01 (one-tailed test)

**Dependent Variable****CAR** = Three-day (days -1, 0, and +1) cumulative abnormal returns**Independent Variables****Assets** = Total assets in the year of the IT investment announcement (Source: Compustat)**Time** = Number of days from the first IT investment announcement in the full sample to the date of each announcement**Financial Firm** = 1 if firm is a financial firm (SIC code 6000-6299); 0 otherwise**Transform Industry IT Strategic Role** = 1 if the firm has membership in an industry characterized as having a transform industry IT strategic role (see Appendix A); 0 otherwise**Transform IT Investment Strategic Role** = 1 if the investment made by the firm is judged to be a transformative investment; 0 otherwise**Lead Variable** = 1 if IT investment strategic role transforms or leads the industry IT strategic role**Lag Variable** = 1 if IT investment lags the industry IT strategic role

All three of the regression models are significant overall.<sup>6</sup> In each case, the variables representing size, time,<sup>7</sup> and financial orientation are dominated by the IT strategic role variables. We find positive and significant returns for industry-level and investment-level IT strategic role in both models 1 and 3, and for industry-level IT strategic role and the *lead* variable in model 2. These findings, thus, are supportive of the influence of a dominant industry strategic role of transform (H1), of transform IT investments (H2), and of firms undertaking IT investments whose strategic role leads that of their industry (H3). We also note positive but not significant stock market returns for the *lag* variable. While investors seem to reward firms that announce IT investments that lead their industry, they do not seem to penalize firms that announcing lagging IT investments. Finally, as argued, the joint effect of an industry-level and investment-level transform IT strategic role appears additive rather than multiplicative. In summary, then, these multivariate results provide strong support for our first, second, and third research hypotheses.

## Discussion

The above results suggest that the factor effects reported in Im et al. (2001) are actually manifestations of the positive returns experienced from transformative IT investments. First, with the passage of time, IT-enabled structural change is occurring in an ever-greater number of industries, including but certainly not limited to financial-services firms. Most likely, this time effect is reflective of an ever-richer portfolio of IT applications, of a maturing in firms' understanding of the enabling role of IT and, as a consequence, of an increased likelihood that complementary invest-

ments in other intangible assets, e.g., worker knowledge, business process redesign, organizational restructuring, and interorganizational relationships (Brynjolfsson and Hitt 1993; Im et al. 2001) required for the realization of positive returns from IT investments (Barua and Mukhopadhyay 2000) and characteristic of industry structural changes (Segars and Dean 2000). Finally, it is generally easier to undertake transformative IT initiatives in smaller firms than in larger firms, regardless of whether or not they are intended to induce structural change within an industry. The dysfunctional factors (goal conflict, communication failure, competing priorities, etc.) inhibiting a successful initiative, especially one that might introduce structural change (Brown and Eisenhardt 1998), tend to intensify with increases in organizational size. Further, it is more likely that IT-enabled initiatives intended to induce structural changes within an industry will be undertaken by smaller firms as larger firms tend to have more to lose if current business practices become noncompetitive.

These findings add to the accumulating evidence regarding the value-adding role of IT. When companies announce IT investments, it was posited, and empirically demonstrated, that investors react positively based on their expectations of a firm gaining a sustained increase in earnings. There are two interrelated reasons for such investor behaviors. First, the benefit streams from the majority of the IT investments made by firms tend to be either short-lived or highly uncertain, and these benefit streams often move, over time, to customers through a lowering of average industry profits. As a consequence, investors are looking for signals promising out-of-the-ordinary gains from IT investments. Second, industries vary in the extent to which IT investments have induced, or are inducing, structural changes in industry and market practices within evolving industry segments. IT-enabled industry structural change is conceptualized as occurring most frequently within certain industries (transform strategic IT role) and occasionally within other industries (automate or informate IT strategic role). As a consequence, when firms announce IT investments, investors look for signals that indicate the investing firm is moving into a more-profitable industry segment—actions very likely to produce long-term value for

<sup>6</sup>We also run the multiple regression analysis using the two-day returns over days -1 and 0 and find similar results throughout.

<sup>7</sup>As a sensitivity test, we measure time as the number of years, or simply as a binary variable that equals one if the announcement is in the later period (1995–1996) and zero otherwise. In neither case do we find significance in the multiple regressions detailed in Table 5.

the investing firm and, thus, significantly influencing investors' firm valuation decisions.

This study makes a significant contribution by showing how IT strategic role (automate, informate, transform) explains the market reaction to IT investment announcements and subsumes the findings of previous research. While IT investments certainly possess the potential to increase an individual firm's profits, the duration of such increases is dependent upon the strategic role of the IT. As transform IT investments can serve as the basis for structural changes within industry practices, they serve to both differentiate the investing firm from others in their industry and induce permanently higher levels of profitability within a new segment within the industry. When transform IT investments come to dominate an industry, the industry is seen as providing a context where IT-enabled initiatives possess a greater likelihood of returning positive, abnormal returns.

From a theoretical perspective, we strongly advocate that research models specified to reflect the effect of IT-related events (such as IT investments) on firms' stock prices incorporate variables that reflect the transformational nature of IT investments as well as the extent to which the firm's industry as a whole is undergoing IT-enabled transformation. What seems clear from our analyses are (1) the importance of capturing within research models the likelihood that the investing firm will experience sustained, extraordinary returns from its IT investments and (2) that such returns accrue from transformational, rather than incremental, IT-enablement.

From a practice perspective, we advocate that firms announcing major IT-related events, such as IT investments that induce structural change in firm and/or industry practices, be sure to clearly articulate both the firm-specific and wider industry implications of the IT-related event. Not surprisingly, IT investments that promise a sustainable stream of extraordinary profits do appear to be well received by the investor community. It is also of interest that investors do not appear to penalize firms announcing IT investments that lag their dominant industry IT strategic role, implying that firms should not be averse to announcing IT-

related events whose intended impact is not expected to be transformational.

## Limitations

Despite our efforts to isolate the IT investment announcements from all other firm news (see the description of the data in the Research Methodology section), it is possible that the results are driven by other contemporaneous events not covered in a press announcement. However, we expect the effect of any contemporaneous events to randomize across the sample firms and have neither a positive nor a negative impact on our results. There is also the possibility that this event was anticipated. If the IT investment announcement was anticipated and leaked to the market in advance of the formal announcement, no abnormal returns would be expected in the three-day event widows. This possible leakage biases us against finding statistically significant abnormal returns during the event period.

In addition, it would seem clear that investors reacting to signals of either transform IT investments or IT investments in transform mode industries do so in conjunction with their perceptions of the likelihood that the firm in question possesses the IT-related capabilities as well as overall managerial capabilities to successfully carry out such IT initiatives. Future research should strive to capture measures of such capabilities and include these as salient firm-specific attributes within the research models being applied.

## Conclusions

In this paper, we examine the influence of IT strategic role to extend those of Im et al. (2001), Dos Santos et al. (1993), and Chatterjee et al. (2002). Specifically, we demonstrate that IT strategic role can explain how IT investments might affect the firm's competitive position and ultimately firm value. We find positive, abnormal returns to firms investing in IT with a transform strategic role and making IT investments in industries undergoing IT driven transformation.

Our results thus provide empirical support for the inclusion of both investment-specific IT strategic role and an industry's prevailing IT strategic role in theoretical models aimed at representing and explaining the conditions under which IT investments are likely to produce out-of-the-ordinary, positive returns. IT-enabled initiatives can be assessed most validly when viewed in the context of competitors' IT-enabled actions and not as isolated events. As Sambamurthy (2000, p. 259-260) argues,

As IT capabilities become one of the strategic levers of competitive strategy and market maneuvering, research is needed to advance knowledge about IT-shaped competitive moves and rivalry.... Researchers should examine the dynamics of these action-response behaviors across firms and industries to generate taxonomies of IT-shaped competitive moves, and identify conditions influencing the effectiveness of these moves.

The IT strategic role metric applied here is a very coarse measurement of an industry's IT-shaped competitive rivalry. Further, it requires the use of a set of very expert judges, a scarce resource that may not be generally available to all researchers. We strongly encourage research that (1) develops and applies finer (and more generally available) measures of this particular variable and (2) conceptualizes and then develops measures for other aspects of IT-shaped competitive rivalry. Such variables and their associated measurement scales are certain to be usefully applied to the broad range of phenomena reflecting the complex interactions among business strategies, IT-enabled initiatives, and business performance.

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## About the Authors

**Bruce Dehning** is an assistant professor of Accounting at Chapman University's Argyros

School of Business and Economics. He holds a B.S. in Finance, an M.S. in Accounting, and a Ph.D. in Accounting from the Leeds School of Business at the University of Colorado. Professor Dehning's current research is on the returns to investments in information technology. Currently he is working on projects investigating the effect of information technology on firm performance, and the market's valuation of IT investments. Bruce has previously published work in *Journal of Strategic Information Systems*, *Information and Management*, *Journal of Information Systems*, and other academic journals. Bruce's work experience is in insurance and as an accounting information systems consultant for small businesses.

**Vernon J. Richardson** is an Associate Professor and KPMG Faculty Scholar in the School of Business at the University of Kansas. Professor Richardson received his Ph.D. from the University of Illinois at Urbana-Champaign. His research interests include the value relevance of intangible assets and information technology investments. Professor Richardson has published articles in *MIS Quarterly*, *Communications of the ACM*, *Journal of Accounting and Economics*, *Journal of Marketing*, *American Business Law Journal* and *Financial Analysts Journal*. He is currently the associate editor at the *Journal of Information Systems*.

**Robert Zmud** is Professor, Michael F. Price Chair in MIS and Director, Division of MIS, Michael F. Price College of Business, University of Oklahoma. His research interests focus on the organizational impacts of information technology and on the management, implementation and diffusion of information technology. He is a senior editor with *Information Systems Research* and with the *Journal of the AIS*, and he currently sits on the editorial boards of *Management Science*, *Academy of Management Review*, and *Information and Organization*. Bob also serves as the research director for the Advanced Practices Council of SIM, International. He holds a Ph.D. (1974) from the University of Arizona and a M.S. from M.I.T.



# Appendix A

## Assessing Industry IT Strategic Role

The instrument sent to the four expert judges is provided along with the mode response value by industry.

Please indicate which of the following best reflects the role of IT in the specified list of industries during the periods 1987–1994 and 1995–1998:

Automate: Replace human labor by automating business processes.  
 Informate Up/Down: Provide data/information to empower management and employees  
 Transform: Fundamentally alter traditional ways of doing business by redefining business processes and relationships

Rating Scale: Automate (A); Information Up/Down (I); Transform (T)

1987–1994	
Industry	IT Role
Airlines	T
Banking	A
Computer Manufacturing	I
Computer Software Products and Services	A
Diversified Chemicals Manufacturer	I
Diversified Foods Manufacturer	I
Electric Equipment, Electronic/Scientific Test & Measurement Instruments Manufacturer	A
Financial Services	A
Fluid Systems Manufacturer	A
Food Services	A
Health Care Products Division	A
Heavy Construction	A
IT Consulting Services	I
Media – Diversified	I
Pharmaceutical Manufacturing	A
Publishing – News Services, Newspapers and Periodicals	A
Retail – Department Stores	I
Retail – Grocery Stores	A
Semiconductor Equipment and Materials Manufacturing	I
Telecommunications Services	A
Transportation – Ground & Railroad	A
Transportation Equipment Manufacturing	A

1995–1998	
Industry	IT Role
Accounting, Bookkeeping, Collection & Credit Reporting	T
Advertising	T
Agricultural Machinery Manufacturing	I
Airlines	T
Automotive Manufacturing	I
Automotive Parts & Service	I
Banking	T
Biotechnology Products/Services	I
Cleaning Products Manufacturing	I
Computer Manufacturing	I
Computer Software Products & Services	T
Diversified Building Materials Manufacturing	I
Diversified Chemicals Manufacturer	I
Diversified Foods Manufacturing	I
Electrical Equipment, Electronic/Scientific Test & Measurement Instruments Manufacturer	I
Financial Services	T
Fluid Systems Manufacturing	I
Food Services	I
Health Care Products Distribution	I
Heavy Construction	I
Information Collection and Delivery Services	T
Internet and Online Service Providers	T
IT Consulting Services	I
Long Term Care Facilities	T
Media – Diversified	T
Metals (Aluminum, Steel) Manufacturer	A
Pharmaceuticals Manufacturer	I
Printing, Photocopying & Graphics Design	I
Publishing – News Services, Newspapers & Periodicals	T
Reinsurance	I
Retail – Apparel/Accessories & Specialty Products	I
Retail – Department Stores & Discount/Variety Stores	I
Retail – Grocery Stores	I
Semiconductor Equipment & Materials Manufacturer	I
Staffing, Outsourcing & Other Human Resources Services	T

Surety, Title and Miscellaneous Insurance	A
Telecommunications Services	T
Telemarketing, Call Centers & Other Direct Marketing	T
Transportation – Ground & Railroad	A
Utilities – Electric	A
Wholesaler – Floral Products & Groceries	T
Wire & Cable Manufacturer	I

## Appendix B

### Assessing the IT Investment Strategic Role of IT Investment Announcements

#### Coding Rules

- Do not code information about IT that is embedded in industrial technology.

#### Automate Rules

- Replace human labor by automating business processes.
- Virtually no IT-driven transformation efforts.
- **Goals:** Improving, applying and refining firm capabilities, substitute labor with computers.
- **Outcomes:** Clearly definable benefits, e.g. cost reduction, process consistency, process efficiency.

#### Automate Examples

- IT providing enhancements to existing processes or practices.
- IT providing a new channel for old information (i.e., using technology to provide traditional services to the deaf, etc.).
- Choosing a long distance carrier without adding new services.

#### Informatize Up/Down Rules

- Provide new data/information to empower management, employees, or customers.
- An intermediate level of IT-driven transformation efforts.
- **Goals:** Better decision making, better coordination and collaboration.
- **Outcomes:** 'Soft' benefits, difficult to evaluate in advance e.g. better decisions shared understanding, clearer picture of cause-effect relationships, greater understanding of operating environment.

#### Information Up/Down Examples

- IT providing new information to customers.
- IT creating new information flows.
- Choosing a long distance carrier to provide new services such as a new network.

## Transform Rules

- Fundamentally alter traditional ways of doing business by redefining business capabilities and/or (internal or external) business processes and relationships.
- Strategic acquisition to acquire new capabilities or to enter a new marketplace.
- Use of IT to dramatically change how tasks are carried out...is the move recognized as being important in enabling firm to operate in different markets, serve different customers...gain considerable competitive advantage by doing things differently.

### Transform Examples

- IT changing the way a marketplace operates.
- IT providing new ability, new services, restructuring the market.
- New IT-based products typically transform.
- Strategic alliances or purchases are typically transform.

# Appendix C

## Examples of Coded IT Investment Announcements

### Automate Example

September 26, 1985, Thursday

**SECTION:** Pg. 2

**LENGTH:** 496 words

**HEADLINE:** Exxon Unveils Point-of-Sale System; MCorp to Be First Bank Participant

**BYLINE:** Special to the American Banker

**DATELINE:** DALLAS

### **BODY:**

Exxon Co. U.S.A. has developed its own communications network to support the acceptance of debit cards at its gas stations around the country.

MCorp, which operates the MPact Electronic Banking Network through its subsidiary MTech, will be the first banking company to participate in Exxon's point-of-sale system.

The system will allow bank customers to purchase gasoline and other products at Exxon stations with their MPact cards.

Exxon Co. U.S.A., a subsidiary of the Exxon Corp., is initiating service with the system in Austin and San Antonio, where it will be available to MPact customers by early December at about 100 stations.

Also late this year, the system will become available at 275 to 300 stations in the Dallas-Fort Worth area. Next year, Exxon's system will be expanded to about 350 Houston-area stations and to other major markets.

Exxon also plans to start operating the system at up to 275 facilities throughout Florida later this year. Eventually, Exxon is expected to have the payment system available in 17,000 stations throughout the nation.

An oil company spokesman said Exxon is negotiating with other banks to accept their cards in the point-of-sale system.

Exxon is also testing its own debit card at stations in the Phoenix area. "The test is still under way," an oil company spokesman said. "We're still looking at that entire area."

Other major oil companies, such as Mobil Oil Corp. and Shell Oil Co., are installing similar systems at their retail stations. Mobil, which also accepts MPact cards, has committed about \$30 million to a point-of-sale program to link all its service stations in 25 states.

An Exxon spokesman said the system is designed to speed transactions and increase the methods of payments available to customers. Some customers may be charged a transaction fee similar to those for using a bank's automatic teller machine.

The gasoline station systems work in a manner similar to automated teller machine transactions. Participating Exxon stations will have card readers that will allow customers to enter their secret codes to complete a transaction.

"Customers authorize transactions using their secret code, the same one used at MPact teller machines," said Darwin Deason, chairman of MTech.

Once the purchase has been electronically authorized and completed, the funds are automatically transferred from the customer's bank account to that of the oil company. "The MPact debit card gives customers a quick and easy means of paying for purchases from their checking accounts without having to write a check," said Ray Hansen, Exxon's western regional sales manager.

Exxon said purchases made with MPact cards will qualify for the four-cent-a-gallon discount given to customers who pay with cash. The oil company said it will continue to accept Exxon credit cards as well as MasterCard and Visa cards.

## **Informat Example**

### **Spectrum awarded contract by Grainger worth 2.5 million dollars for technology implementation to automate sales force**

202 words

28 April 1993

Business Wire

English

(Copyright (c) 1993, Business Wire)

DALLAS—(BUSINESS WIRE)—Grainger, a division of W. W. Grainger Inc., has awarded Spectrum Information Technologies, Inc. (Spectrum) (NASDAQ: NMS: SPCL) a contract to provide part of its sales force with a computerized sales support tool that will improve responsiveness to customer needs and enhance the effectiveness of its account executives.

Under the agreement worth 2.5 million dollars, Spectrum's subsidiary DATA ONE, is providing Grainger with portable computer hardware, project integration services, and technical support services for sales personnel. The program will be rolled out during the end of the second quarter.

Spectrum Information Technologies, Inc. is headquartered in Manhasset, N.Y., with facilities nationwide.

Spectrum develops and licenses wireless data transmission technologies through its subsidiary Spectrum Cellular Corp. The company designs, markets and services portable communications and computing systems as a systems integrator through its subsidiary DATA ONE. Spectrum is a distributor of portable computers through its subsidiary Computer Bay, which has the resources of 270 franchise locations.

CONTACT: Spectrum Information Technologies Inc., New York Kathy Bachand, 800/FOR-SPCL Peter T. Caserta, 516/627-8992 11:12 ET APR 28, 1993

### **Transform Example**

#### **American Greetings to Sell Cards Using the Internet**

158 words

2 May 1995

The Wall Street Journal

B6

English

(Copyright (c) 1995, Dow Jones & Co., Inc.)

CLEVELAND — American Greetings Corp. said it will sell greeting cards on the Internet World Wide Web in an alliance with Oakton, Va.-based PC Flowers & Gifts Inc.

For \$3.99 each, consumers can pick out a card, personalize it and type in the name and address of the recipient. Then the card is mailed by American Greetings. Consumers pay by entering their credit-card numbers.

American Greetings said the service is the first of its kind on the Internet World Wide Web. "While the sale of greeting cards in these on-line and electronic channels of distribution is minimal now, we realize that this is an emerging market," the company said. "By forming alliances with key players on the information highway, we are in a position to generate incremental sales and growth for the company in the future when on-line services begin attracting more significant consumer usage."