

Stock Price Reactions to Investments in EAI and ERP: A Comparative Event Study

Narczyz Roztocki
School of Business
State University of New York at New Paltz
roztockn@newpaltz.edu

Heinz Roland Weistroffer
School of Business
Virginia Commonwealth University
hrweistr@vcu.edu

Abstract

The study described in this paper contributes to the growing repository of event studies in the field of information technology (IT) research. The empirical results presented in this paper indicate that financial markets differentiate among technologies that companies invest in to integrate their information systems. In addition, this study confirms that technology maturity, financial health of the investing company, and stock market conditions are important factors influencing stock market reaction.

1. Introduction

In today's business environment, the widespread use of information technology (IT) is prevalent in practically all organization. Unfortunately, many organizations rely on various, disparate systems and technologies, which need to work together in an integrated fashion to achieve real business value [1, 2].

Essentially, there are two major ways to integrate diverse IT systems and business functions in an organization: *Enterprise application integration* (EAI) technology and *Enterprise resource planning* (ERP) systems.

EAI technology is sophisticated middle ware which allows combining the various systems for integrated business operations [3]. ERP systems, on the other hand, are complex software packages which implement the business functions for the whole enterprise by integrating all internal corporate data as well as necessary external data [4].

Thus, there are major differences in achieving integration of business operations by EAI or ERP. The former approach combines the operations of various existing systems using additional software, whereas the latter replaces most of the existing systems by a new mega system. In contrast to EAI, ERP implementations would seem to be much more risky investments and require substantially more managerial effort. The implementation of an ERP system is not only more costly to start with, but also requires substantial changes of business processes, thus potentially severely impacting the operations of the whole organization [5].

Irrespective of the differences between EAI and ERP, the advantages of achieving organizational integration [1] of business functions and data by either approach seem to be substantial, and thus should positively affect the business performance of the investing organization.

Consequently, several studies have tried to assess the contribution of EAI and ERP systems to firm performance. Among other methods or methodologies, several authors have embraced event studies to gauge the performance of EAI and/or ERP investments by looking at the stock market reaction.

The fundamental idea behind event study methodology is the premise of the efficiency of the stock market. In an efficient market, the stock price reflects all available information at all times [6, 7]. When unexpected, but relevant news reach the financial markets, the stock prices move as a result. Thus, event studies, by looking at the changes in stock prices, are used to determine influential factors from an investor's perspective. Stock prices are well-accepted proxies for firm performance.

Regarding EAI implementations, one published event study used 81 announcements from the time period 1998 to 2005 [8]. This study examined to which extent the EAI technology follows a life cycle. Accordingly, the study tested for possible differences between early investments in EAI, when the technology was still new and emerging, with comparable implementations conducted in later years, when this technology was more mature and established. The study also examined the possible effects of the financial health of the organization making the EAI technology investment, and prevailing stock market conditions at the time of the announcements of the investments.

Regarding ERP implementations, at least two major event studies have been published. One study examined the stock price reaction to 91 ERP investment announcements in the time period 1990-1998 [9]. This study reports a significant positive stock market reaction to the announcements. The second study used 116 announcements of ERP implementations for the years 1997-2001 [10]. This study also reports a positive market reaction.

Although these three studies contributed substantially to the repository of event study research

in the field of IT, they are subject to critical limitations. Overall, to derive valid conclusions for the current business environment, the data used in the two ERP event studies may be considered obsolete. It is quite possible that investments in ERP produce different results now, than they did in the time periods considered by these previous studies, since the technology has matured and is now considered standard. In addition, the increased globalisation of supply chains make investments in integration technologies such as EAI and ERP more of a necessity of staying in business rather than a move to gain competitive advantage. Furthermore, there is lack of empirical studies comparing the business value of the most important integration tools EAI and ERP.

The objectives of the event study described in this paper are, therefore, two-fold. The first objective is to validate the previously published event studies by using more recent data. The second objective is to discover possible differences in stock market reactions to EAI and ERP announcements.

The paper is structured as follows. After the introduction, based on previous published event studies, four research hypotheses are derived. The following section describes the research methodology, data collection and data analysis. Then the results of the analysis and implication for the research hypotheses are discussed. Finally, limitations, contribution and future research opportunities are presented.

2. Theoretical background and hypotheses development

The results of previous event studies in the field of IT research suggest that investments in IT in general do not lead to significant abnormal stock price reaction. However, significant abnormal reaction can be expected under specific conditions, i.e. when additional factors related to the investment announcements are identified.

Regarding specifically the investments in EAI, an earlier study reported insignificant negative abnormal reaction [8]. In contrast, two earlier studies based on 91 and 116 announcements in the time periods 1990-1998 and 1997-2001, as mentioned earlier in this paper, reported significantly positive stock price reactions to ERP announcements [9, 10].

Regardless of these results, specifically with respect to ERP investments, we argue that using more recent data will produce different results. The earlier studies used primarily older announcements, from a time when the ERP technology was relatively new and could bring a company a competitive advantage. In contrast, in more recent years (perhaps 2000 and beyond) ERP systems have become standard technology and only seldom lead to competitive advantage.

Thus for the full sample of the companies investing in EAI and ERP, we hypothesize:

H1: Similarly to announcements of investments in EAI, announcements of investments in ERP do not cause abnormal reactions in stock prices.

Embracing a new technology may provide an opportunity to achieve competitive advantage over those competitors that lag behind. Indeed the previous event study, which compared innovative with non-innovative investments in IT, suggests that stock markets react positively when a company is one of the first embracing a given technology [11].

It is for example possible that companies which embraced ERP systems in the late 1990s were able to derive tangible gains. These companies were able to enjoy the advantages of integration while their rivals were struggling with fragmented systems. However, as EAI and ERP have become standard, the risks accompanying implementations have decreased, but the opportunities to gain competitive advantages this way also have faded away.

Accordingly, an earlier study on investments in EAI indicates that the stock price reaction decreases as this technology become more mature [8]. As mentioned earlier in this section, regarding investments in ERP systems, two studies reported positive stock price reactions for 1990-1998 and 1997-2001 [9, 10]. Concerning more recent years, it is quite likely that announcements of investments in ERP only marginally affect the investors' attention, as the use of this technology is now standard and expected.

Thus we hypothesize:

H2: Similarly to announcements of investments in EAI, the degree of stock price reactions to announcements of investments in ERP changes with time.

The attention-based view of the firm [12] suggests that average investors try to avoid poor investments while always looking for better opportunities [13]. In other words, investors tend to disinvest in financially unhealthy companies, whose management is unable to fix the apparent organizational problems. In contrast, investors seem to be attracted by management showing serious, tangible improvements in their organization.

Often, managers invest in IT in an effort to compensate for serious organizational troubles. Some of these investments may result in improvements, but often, they may also cause additional problems. For example, a company experiencing a shrinking customer base may invest in *customer relationship management* (CRM) technology. However, when the problems with customer retention are direct results of obsolete products and increased competition, the new CRM system will hardly help to reverse this trend. Quite

opposite, it may add to financial liabilities and reduce resources needed for more fundamental restructuring.

Investments in EAI result in technical integration and have a rather modest effect on company business processes. In contrast, ERP implementations force companies to change their way of doing business and adapt to the processes prescribed by the ERP systems [5]. Such changes in business processes may cause serious disruption, but finally result in more efficient operations.

Indeed, an earlier event study suggests that especially financially unhealthy companies benefit from ERP investments [9]. In the context of that study, financial health was measured by Altman's Z.

In addition to Altman's Z, security's beta [14], from the Capital Asset Pricing Model (CAPM) [15, 16], provides a reasonable estimate of market risk and financial health. Consequently, underperforming, financially unhealthy companies tend to have a higher beta than their better performing competitors. In other words, companies with high beta may be expected to benefit from an ERP implementation to a greater degree as it forces them to improve their business practices. Thus, we hypothesize:

H3: Contrary to announcements of investments in EAI, stocks of firms with high beta will not respond negatively to announcements of investments in ERP.

According to the earlier study on stock market reaction to EAI announcements [8], market conditions seem to be a highly influential factor. In general, during favorable conditions (i.e. in a bull market) the stock market reaction to EAI investments is positive, but insignificant. In contrast, during unfavorable market conditions (i.e. in a bear market) the reaction to EAI investments is significantly negative. In other words, during bear market conditions investors seem to be more skeptical about tangible benefits from EAI investments and tend to sell rather than buy stocks.

In contrast to EAI, as mentioned earlier, investments in ERP may be expected to result in improvements to the way the company is conducting business. In essence, an ERP system will require conducting business in a more systematic way and, therefore, foster efficiency and effectiveness. ERP implementation and use may support radical restructuring efforts. Thus, we believe that investors will value the investments in ERP despite the unfavorable market conditions. Therefore we hypothesize:

H4: Contrary to announcements of investments in EAI, during unfavorable market conditions, stocks will not respond negatively to announcements of investments in ERP.

Figure 1 depicts a graphical representation of the research model showing the four hypotheses.

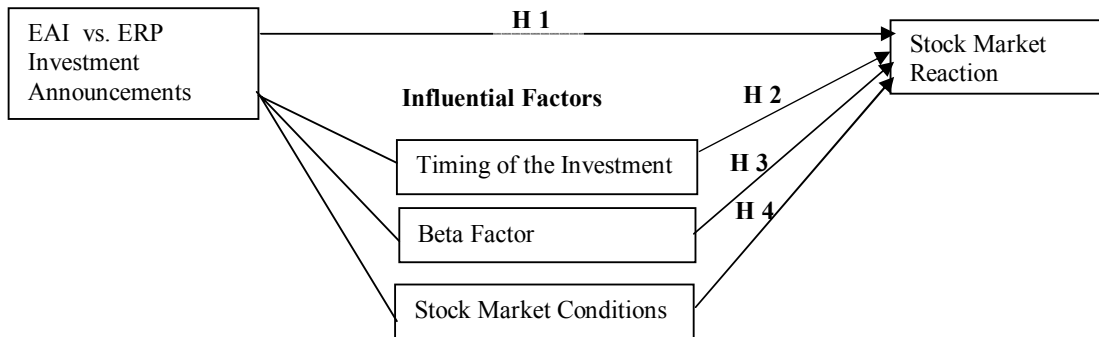


Figure 1. Research model

3. Research Methodology

3.1 Event Studies

In conducting our research we followed the standard event study methodology [17]. Since one of our objectives was to validate and expand the findings of previous event studies, this methodology appeared to be the most reasonable choice.

Since the early 2000s, the event study approach has become well established and accepted in the field

of IT to examine different aspects of IT investments. To this end, several researchers have used this methodology to compare the value of innovative versus non-innovative IT investments [11], as well as industry and size of investing companies [18].

Other researchers have used the event study approach to assess the potential value of creating a CIO position [19] and engaging in e-commerce [20]. In another study, the author compared exploitative versus exploratory IT investments [21]. Often subsequent studies expanded and validated the

findings of prior studies by using secondary data, as in our case, from earlier studies. For example, an event study comparing transformational with non-transformational IT investments [22] used consolidated secondary data from three prior event studies [11, 18, 23].

3.2 Sample selection

The hypotheses were tested using both primary and secondary data. Consequently, EAI announcements were obtained from an earlier event study investigating this topic [8]. Primary data, the announcements about ERP investments, were retrieved from Lexis-Nexis using various search queries containing word combinations such as enterprise resource planning and acronyms such as ERP. In addition, we also used the names of major ERP vendors such as SAP, Oracle, PeopleSoft, J.D. Edwards. To minimise the selection bias we also included a number of smaller vendors.

Most of the searches yielded a very large number of announcements. To make the numbers manageable, we limited each search to a specific time span, repeating the searches for different times. A careful reading of the obtained announcements revealed that the majority of the announcements were not relevant to our research because they did not satisfy the following two major inclusion criteria: First the announcements had to be related to ERP implementation. And second, the stock of the announcing company had to be traded on the US stock exchange and the stock data from the University of Chicago’s Center for Research in Security Prices (CRISP) had to be available and complete.

We also searched for confounding events in the event window. If confounding events, such as dividend and earning announcements or unexpected changes in top management for the investing companies during the event windows existed, the announcements were excluded from the final sample. In addition, many of the announcements were duplicates describing the same ERP investments. In such a case we only included the first announcement. If there were more than one announcement with the same date, we included only the announcement which provided the most details about the implementation.

3.3 Sample description

The sample of announcements is depicted in Table 1. The first announcements about EAI were from 1998. In contrast, the first announcements about ERP implementation were from 1994. The ERP implementations peaked in the late 1990s, as many companies invested in ERP before 2000, in order to be prepared for “Y2K” and “Euro-readiness”.

Overall, while companies reported mostly first investment in ERP in the 1990s, later investments in ERP were mostly replacements of existing ERP systems, or were related to growth-through-acquisition of firms and consolidation of existing ERP systems.

Table 1. Sample distribution

Year	EAI	ERP
1994		2
1995		1
1996		2
1997		6
1998	5	13
1999	6	6
2000	16	5
2001	20	4
2002	8	4
2003	6	3
2004	10	1
2005	10	1
Total	81	48

3.4 Analysis

For a better comparison with prior published research, while designing this study, our aim was to follow comparable methods applied in earlier event studies in the field of IT [11, 18]. Consequently, stock price reaction to announcements in our sample was assessed through unexpected or abnormal returns (AR) calculated based on the widely used market model [24]. AR_{it} , for company i on day t , possibly the consequence of an announcement about an IT investment, is the difference between the actual return R_{it} and the projected return based on the market model:

$$AR_{it} = R_{it} - (\alpha_i - \beta_i R_{mt}),$$

where R_{mt} is the market return (estimated by the CRISP or SP 500 index) on day t , and α_i and β_i are parameters for company i , estimated by regression analysis of daily returns of stock i against daily returns of the stock market.

Regarding our study, the α_i and β_i parameters were estimated using a 200-day period, starting 201 days and ending 2 days before the announcement. There is no general agreement on the length and time of the most suitable estimation period, and some studies use different lengths or have the estimation period end earlier (e.g. 60 days prior to announcement). There is no evidence that using different estimation periods results in significantly different results.

As proxy for stock market returns we used the daily return of the SP 500 index. One reason for using this particular market index was the fact that

many of the companies in our sample were included in SP 500.

In accordance with the earlier studies, we standardized AR by dividing it by the standard deviation. Thus, standardized abnormal return (SAR) for company i on day t , is calculated as follows:

$$SAR_{it} = \frac{AR_{it}}{SD_{it}},$$

where

$$SD_{it} = \sqrt{S_i^2 \times \left(1 + \frac{1}{T} + \frac{(R_{mt} - R_m)^2}{\sum_{t=1}^T (R_{mt} - R_m)^2}\right)},$$

and S_i is the standard deviation of residual returns for company i as calculated from the market model. R_{mt} is the market return on day t in the estimation period and R_m is the arithmetic average of all market returns during the estimation period. T represents the number of days in the estimation period. As stated earlier, our estimation period was 200 days, so $T = 200$.

To measure the stock price reaction to the IT investments, two different event windows were used, both starting one day before the announcement (day -1), but the one ending on the day of the announcement (day 0), and the other ending one day after the announcement (day 1). Thus, the first event window is denoted as (-1,0) and the second as (-1,1). For each of the event windows, cumulative abnormal returns (CAR) were calculated by summing the AR for the days of the event window.

The stock price reaction was further tested for significance using cumulative standardized abnormal returns (CSAR) for each company, calculated for each of the event windows (-1,0) and (-1,1) as follows [11]:

$$CSAR_i = \sum_{t=t_1}^{t_2} \frac{SAR_{it}}{\sqrt{t_2 - t_1 + 1}},$$

where t_1 is the first day of the event period and t_2 is the last day of the event period. In our case t_1 was always day -1, while t_2 was 0 for the event window (-1,0) and 1 for the event window (-1,1).

The stock price reaction was further tested for significance using:

$$Z = \frac{\sum_{i=1}^N CSAR_i}{\sqrt{N}},$$

where N denotes the number of firms (or events) included in the sample or subsample. A Z value close to zero would indicate that the observed results are not significant, i.e. that the observed “abnormal” returns may be due to chance variation.

4. Results

The results of our analysis are shown in Table 2. To test hypothesis 1, the full sample of EAI and ERP announcements was used. For hypothesis 2, the sample was broken down into three subsamples, representing announcements from the periods 1994-1997, 1998-2001, and 2001-2005. These time spans were chosen to better compare our results with the results of the previous event study on EAI. Also consistent with the earlier study, for testing hypothesis 3, the sample was broken down into two subsamples, announcements by companies with beta factor below 1.2 (low risk), and announcements by companies with beta factor at least 1.2 (high risk). For hypothesis 4, the sample was broken down into two groups representing announcements made in a bull market and announcements made in a bear market.

As indicated by the calculated Z values, only the results for EAI investments with high beta, and the results for bear market conditions are significant. For the ERP investments, the only significant result is for the early time period, 1994 to 1997. These results hold equally for both event windows used (though the level of significance differs).

For our full sample, the announcements about both EAI and ERP investments lead to negative, though statistically insignificant, stock reactions, the extent of this reaction being comparable for EAI and ERP, as depicted in Table 2. Since the changes in stock prices are insignificant, the first hypothesis, that these investment do not result in abnormal stock returns, is supported.

The magnitude of stock price reaction seems to change over time. As presented in Table 2, for both technologies, the stock price reaction was initially negative, and became positive in later periods. For ERP announcements, the initial negative stock price reaction was statistically significant. As the years, passed and the technologies matured, the stock price reaction became positive, however insignificantly. Based on these results, the second hypothesis, that the degree of stock price reaction changes over time, is supported.

Regarding the beta factor, the stock markets seem to differentiate between technologies. As expected and indicated by previous studies [8], for

companies with high beta, announcements of EAI investments resulted in statistically significant, negative stock price reactions. In contrast, announcements of ERP investments by companies with comparably high beta resulted in insignificant positive stock price reactions. This gives support for the third hypothesis that stocks of firms with high beta do not necessarily respond negatively to investments in ERP.

Concerning the investment during bull markets both announcement types, EAI and ERP, receive

insignificant stock price reaction. In contrast, during the bear markets, EAI investment announcements result in a statistically significant, negative stock price reaction. Thus, the fourth hypothesis, that during unfavourable market conditions investments in ERP do not result in negative stock price reaction, is supported.

In summary, the results presented in Table 2 indicate that all four hypotheses are supported, as explained in Table 3.

Table 2. Results

Sample	EAI Investment Announcements					ERP Investment Announcements				
	# of Announcements	CSAR [-1,0]	Z-Value	CSAR [-1,1]	Z-Value	# of Announcements	CSAR [-1,0]	Z-Value	CSAR [-1,1]	Z-Value
Full sample	81	-0.086	-0.78	-0.084	-0.45	48	-0.088	-0.61	-0.113	-.78
Breakdown by time										
1994-1997						11	-0.522	-1.73*	-0.545	-1.81*
1998-2001	47	-0.181	-1.25	-0.225	-1.54	28	0.015	0.79	-0.041	-0.22
2002-2005	34	0.045	0.26	0.111	0.65	9	0.124	0.37	0.189	0.57
Breakdown by beta factor										
below 1.2	64	0.024	0.19	0.017	0.13	43	-0.109	-0.71	-0.150	-0.98
1.2 or higher	17	-0.501	-2.07**	-0.464	-1.91*	5	0.097	0.22	0.221	0.45
Breakdown by stock market conditions										
Bull market	46	0.192	1.31	0.117	0.79	39	-0.047	-0.29	-0.079	-0.50
Bear market	35	-0.453	-2.68***	-0.348	-2.06**	9	-0.263	-0.79	-0.260	-0.78

* Significant at $\alpha=0.1$ ** Significant at $\alpha=0.05$ *** Significant at $\alpha=0.01$

Table 3. Summary of results

Hypothesis	Results	Comments
1	Supported	In general, neither announcements of investments in EAI nor announcements of investments in ERP result in significant stock movements
2	Supported	For both, investments in EAI and ERP, the magnitude of stock price reactions seem to diminish as technology becomes more established. Initial, on average, negative stock price reactions become positive as the technology matures
3	Supported	In contrast to announcements of investments in EAI in companies perceived as risky investments, announcements of investments in ERP in companies perceived as risky investments do not result in negative stock price reactions
4	Supported	Under unfavorable stock market conditions, in contrast to announcements of investments in EAI, announcements of investments in ERP do not result in negative stock price reactions

5. Discussion

Our research presented in this paper confirms some of the results of previous studies, but also

produced some less expected results. In contrast to the earlier event studies on ERP implementations [9, 10], our results indicate that such investments on average do not lead to positive stock price

reaction. Some earlier studies reported positive stock price reactions to ERP investments in general.

In line with other studies [9], our results confirm that ERP implementations can be of advantage to financial unhealthy companies. The investors may see ERP implementation as a way to improved business operations.

It is also possible, that investors are confident that because of its importance, most ERP implementations will receive the necessary support by top management. It is well accepted that top management commitment is perhaps the most important factor ensuring the success of IT investments [25]. As mentioned earlier, the financial and organizational risks from an unsuccessful ERP project are high and may even put some companies into bankruptcy [26]. It therefore would appear evident that in its own interest, top management will provide all the support needed for an ERP implementation.

According to Mitchell [2], EAI projects are particularly troublesome. The stock market returns seem to support these concerns, especially for companies perceived as above average risk (high beta) and during adverse market conditions (bear market).

Thus, regarding unfavourable economic and stock market conditions (bear market), it seems that investors nevertheless acknowledge the value of ERP implementations, but in contrast, do not favor investments in EAI.

6. Limitations, contributions, and future research

One limitation may be related to the queries used in finding the sample set of announcements. Since some well known vendor names were included in the searches, the resultant sample may have been biased toward larger vendors.

A second limitation may be that we included only companies that were included in the CRISP database. Consequently, we dropped a substantial number of announcements, and companies which have gone out of business or merged with other companies since the original announcements were not included. Thus our sample may be biased toward more successful companies.

A third limitation of our study, as for all event studies, is that we based our conclusions on public announcements. Many companies are conducting investments in EAI or ERP, but they try avoiding publicity about these investments. Thus, our sample may be biased toward companies with higher transparency level.

A fourth limitation is a relatively small sample of ERP announcements. Although, the current sample assures sufficient statistical power to draw preliminary conclusions, a larger collection of ERP

announcements would definitely benefit our analysis.

Finally, a fifth limitation is related to accounting for confounding news. Though we tried to eliminate announcements of companies with related confounding events, we may not always have been able to identify all such confounding events.

Despite these limitations, our research contributes to the literature on stock market reactions to IT investments by adding to the list of known influential factors, specifically innovation content, strategic importance, and focus. Our study shows that with IT investments, the market places high importance on technology type, and our study provides evidence that ERP and EAI implementation announcements are perceived by investors very differently.

The results of our research seem to have important implications for business managers. For example, it appears that stock market investors pay significant attention to business investments in IT and differentiate among the various types of technology being invested in.

The outcomes of our study may also benefit academic scholars, as it provides ideas for several futures research projects.

In addition to validating our results with a greater number of announcements, future research may look at how changes in commodity prices may impact some industries. For example, energy prices may effect stock price reaction to IT investments.

Moreover, future research may also look for additional influential factors. Such factors may include additional firm characteristics, such as size, industry, diversification level. Additionally, the effects of a firm's past experiences with IT projects could be investigated.

References

- [1] H. Barki and A. Pinsonneault, "A Model of Organizational Integration, Implementation Effort, and Performance," *Organization Science*, 16(2), pp. 165-179, 2005.
- [2] V. Mitchell, "Knowledge Integration and Information Technology Project Performance," *MIS Quarterly*, 30(4), pp. 913-939, 2006.
- [3] M. Themistocleous, "Justifying the decision for EAI implementation: a validated proposition of influential factors," *The Journal of Enterprise Information Management*, 17(2), pp. 85-104, 2004.
- [4] D.-G. Ko, L.J. Kirsch, and W.R. King, "Antecedents of Knowledge Transfer from Consultants to Clients in Enterprise System Implementations," *MIS Quarterly*, 29(1), pp. 59-85, 2005.

- [5] T.H. Davenport, "Putting the Enterprise into the Enterprise System," *Harvard Business Review*, 76(4), pp. 121-131, 1998.
- [6] E.F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," *The Journal of Finance*, 25(2), pp. 383-417, 1970.
- [7] E.F. Fama, "Efficient Capital Markets: II," *The Journal of Finance*, 46(5), pp. 1575-1617, 1991.
- [8] N. Roztocky and H.R. Weistroffer, "How Do Investments in Enterprise Application Integration Drive Stock Prices?" in *Proceedings of the 40th Hawaii International Conference on System Sciences (HICSS)*, 2007.
- [9] D.C. Hayes, J.E. Hunton, and J. Reck, "Market Reaction to ERP Implementation Announcements," *Journal of Information Systems*, 15(1), pp. 3-18, 2001.
- [10] C. Ranganathan and C.V. Brown, "ERP Investments and the Market Value of Firms: Toward an Understanding of Influential ERP Project Variables," *Information Systems Research*, 17(2), pp. 145-161, 2006.
- [11] B.L. Dos Santos, K. Peffers, and D. Mauer, "The Impact of Information Technology Investment Announcements on the Market Value of the Firm," *Information Systems Research*, 4(1), pp. 1-23, 1993.
- [12] W. Ocasio, "Towards an attention-based view of the firm," *Strategic Management Journal*, 18(Summer Special Issue), pp. 187-206, 1997.
- [13] R. Gulati and M.C. Higgins, "Which ties matter when? The contingent effects of interorganizational partnerships on IPO success," *Strategic Management Journal*, 24(2), pp. 127-144, 2003.
- [14] R.J. Fuller and G.W. Wong, "Traditional versus Theoretical Risk Measures," *Financial Analysts Journal*, 44(2), pp. 52-57, 1988.
- [15] J. Lintner, "The Evaluation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *The Review of Economics and Statistics*, 47(1), pp. 13-37, 1965.
- [16] W.F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *The Journal of Finance*, 19(3), pp. 425-442, 1964.
- [17] A. McWilliams and D. Siegel, "Event Studies in Management Research: Theoretical and Empirical Issues," *Academy of Management Journal*, 40(3), pp. 626-657, 1997.
- [18] K.S. Im, K.E. Dow, and V. Grover, "Research Report: A Reexamination of IT Investment and the Market Value of the Firm - An Event Study Methodology," *Information Systems Research*, 12(1), pp. 103-117, 2001.
- [19] D. Chatterjee, V.J. Richardson, and R.W. Zmud, "Examining the Shareholder Wealth Effects of Announcements of Newly Created CIO Position," *MIS Quarterly*, 25(1), pp. 43-70, 2001.
- [20] M. Subramani and E. Walden, "The Impact of E-Commerce Announcements on the Market Value of Firms," *Information Systems Research*, 12(2), pp. 135-154, 2001.
- [21] S.D. Hunter, "Information Technology, Organizational Learning, and the Market Value of the Firm," *The Journal of Information Theory and Application*, 5(1), pp. 1-28, 2003.
- [22] B. Dehning, V.J. Richardson, and R.W. Zmud, "The Value Relevance of Announcements of Transformational Information Technology Investments," *MIS Quarterly*, 27(4), pp. 637-656, 2003.
- [23] D. Chatterjee, C. Pacini, and V. Sambamurthy, "The Shareholder-Wealth and Trading-Volume Effects of Information-Technology Infrastructure Investments," *Journal of Management Information Systems*, 19(2), pp. 7-42, 2002.
- [24] S.J. Brown and J.B. Warner, "Using Daily Stock Returns: The Case of Event Studies," *Journal of Financial Economics*, 14(1), pp. 3-31, 1985.
- [25] P. Weill, "The Relationship between Investment in Information Technology and Firm Performance: A Study of the Valve Manufacturing Sector," *Information Systems Research*, 3(4), pp. 307-333, 1992.
- [26] S.V. Grabski and S.A. Leech, "Complementary controls and ERP implementation success," *International Journal of Accounting Information Systems*, 8(1), pp. 17-39, 2007.