Middle-East Journal of Scientific Research 10 (3): 356-365, 2011
ISSN 1990-9233

The Impact of Enterprise Systems on Corporate Performance

[1]Fakhrodin Maroofi, [2]Farzad Sadeghi and [2]Amin Mojoodi

[1]Department of Business Management, Kurdistan University, Kurdistan, Iran
[2]Department of Business Management, Andimeshk Branch, Islamic Azad University, Andimeshk, Iran

Abstract: Purpose- This research study the effect of investments in Enterprise Resource Planning (ERP), Supply Chain Management (SCM) systems on a firm's long-term stock price performance and profitability measures such as return on assets and return on sales. Design/methodology/approach- Sarmayeh Gozari Bahman, Lizing Iran, Lizing Khodrove Saipa and the Lizing Saneet Maeeden, Journal is our primary sources for collecting the sample of firms that have invested in ES. We started with the set of all announcements during 2003-2009 that mention ES providers by name. Although more than 75 providers are used in our search for SCM systems. Our sample consists of 978 firms with the following breakdown: 558 announcements of investments in ERP systems, 420 in SCM systems. Findings-The results for improvements in profitability are stronger in the case of ERP systems. On average, adopters of SCM system positive stock returns as well as improvements in profitability. Although our results are not uniformly positive across the different enterprise systems (ES), they are encouraging in the sense that despite the high implementation costs. This should make less help to concerns that some have expressed about the viability of ES given the highly publicized implementation problems at some firms. Research limitations/implications-In using stock price and accounting data, we are not able to examine internal firm mediating factors that may influence the financial value from ES. The linkage between internal capability factors and financial performance is not always clear. Originality/value-This paper provides an empirical analysis of The impact of enterprise systems on corporate performance and also proposes a framework for future studies.

Key words: Enterprise Resource Planning (ERP) · Supply Chain Management (SCM) · Paper type Research paper

INTRODUCTION

Great social changes primarily occur in the area of organizations and their performance [1]. Business environments are unstable and unpredictable as a result of economic globalization, technological change, customers' increasing demands and stiffer competition. Hence, business management has become more complicated [2].

In such business environment,the aim of this study is analysing the effect of investments in Enterprise Resource Planning (ERP), Supply Chain Management (SCM) systems on a firm's long-term stock price performance and profitability measures such as return on assets and return on sales.

For the purposes of this paper enterprise systems (ES) include of the Enterprise Resource Planning (ERP), Supply Chain Management (SCM) systems. This paper studies the effect of investments in ERP, SCM systems on long-run stock price and profitability performance. The results are based on an analysis of a sample of 558 announcements of ERP implementations, 420 SCM implementations at publicly traded firms. Performance effects are examined over a three-year time period for ERP implementations and a two-year time period for SCM. Performance effects are also examined for the implementation and post-implementation periods. There is relatively little empirical research that links investments in ES to financial performance using objective financial performance data. While some researchers have examined the effect of investments in ERP systems on financial performance, research on the effect of SCM systems on financial performance is very limited or nonexistent. Furthermore, existing research on the effect of ES systems on financial performance is not as comprehensive and detailed as it could be in terms of the metrics used, the

Corresponding Author: Fakhrodin Maroofi, Department of Business Management, Kurdistan University, Kurdistan, Iran. Tel: +989183713002.

methodology used to estimate the performance effects and the time periods covered. Our analysis provides complete evidence on the effect of ES system on performance. The evidence in this paper also contributes to the literature on the effect of information technology (IT) investments on financial performance [3]. Very few studies have attempted to examine the effects of specific type of IT investments on performance [4]. Therefore, our knowledge about how specific IT investments affect performance is limited. Such knowledge can be useful in capital budgeting and allocating decisions and targeting investments to those applications that give the highest returns. Investments in ES systems require major commitments of capital and managerial resources and it makes sense to carefully estimate the returns from these investments. In documenting the effect of ES, researchers have used objective performance data on stock returns and methods to analyze the short-term stock market reaction and accounting metrics as well as performance data collected through surveys and experiments. Hayes *et al.* [5] and Ranganathan and Samarah [6] Chatterjee *et al.* [4] examine the stock market reaction to IT investment announcements about technologies. These studies find statistically significant abnormal stock market returns ranging anywhere from 0.9% to 0.78%, indicating that the market reacts positively to IT investment announcements.

However, abnormal returns over short windows may not provide a complete assessment of the value of investment. Recent research has shown that the stock market partially anticipates many corporate announcements and in other cases abnormal stock price performance is also observed subsequent to the announcement [7]. Therefore to suggests that to get a better idea of the value of ERP investments, we estimate abnormal performance over a longer time period. Mabert *et al.* [8] found that few firms had reduced direct operational costs. Stratman's [9] survey found that manufacturing firms saw little change in operational metrics. Hunton *et al.* [10] suggest that survey-based and experimental research could be further supported by triangulation with findings based on objective performance data. Hitt *et al.* [11] found evidence of improved financial performance during implementation, but are unable to estimate the long-run impact of ERP systems due to a lack of post-implementation data at the time they conducted their study. Barber and Lyon [12] in their studies show that in use of accounting metrics matching on prior performance is critical to get a powerful test statistics. Matching on prior performance adjusts for mean reversion in accounting metrics that reflects a transitory component of performance that may have nothing to do with the event under consideration. Without matching on prior performance, results can be confounding as it is unclear whether the observed abnormal performance is due to mean reversion or due to the event under consideration. Dehning *et al.* [13] investigate the financial benefits of SCM systems and find that these systems generally are associated with improved financial performance. Unlike Poston and Grabski's [14] analyses of ERP adoptions, Dehning *et al.* [13] control for industry and economy-wide effects by using the median industry performance as benchmark. While this is certainly better than not using any controls, they do not control for prior performance as advocated by Barber and Lyon [12]. The above critique of the existing study identifies some significant gaps in our understanding of the effect of ES system on financial performance which shows major differences between our studies. We examine the effect of ES on both the long-term stock returns and profitability to examine the consistency between different categories of performance measures. In the long run both the stock price changes and profitability changes should point to the same conclusion about the effect of ES on performance. We examine performance effects for the implementation and the post-implementation periods. Finally, to separate the effect of ES on performance, we use methodologies that address some of the estimation and statistical concerns and drawbacks of previous studies. In particular, we control for prior performance, which has been shown to result in well-specified statistical tests [15, 16].

ERP Systems: ERP systems replace complex and manual interfaces between different systems with standardized, cross-functional transaction automation. Order cycle times can be reduced, customer response times and delivery speeds [17, 18]. Automated financial transactions can reduce cash-to-cash cycle times and the time needed to settle financial data at the end of the year [8, 9, 19]. Another benefit of ERP systems is that all enterprise data are collected once during the initial transaction, stored and updated in real time. This ensures that all levels of planning are based on the same data and that the result reflects the prevailing operating conditions of the firm. The standardized firm-wide transactions and stored enterprise data facilitate the governance of the firm [20, 21]. ERP reports provide managers with a clear view of the relative performance of the various parts of the enterprise, which can be used to identify and take advantage of market opportunities [22, 23].

SCM Systems: The benefit of SCM systems is better operational and business planning. Excellence in Supply Chain performance is a key element in an organization`s success [24]. SCM systems use finite capacity planning algorithms that do not require iteration adjustments to the schedule [25] and real-time planning capabilities allow firms to react quickly to supply and demand changes. There is a rich literature in OM on the benefits of better supply chain planning and coordination [26, 27]. Recent empirical research has demonstrated that reducing forecasting and planning errors that result in supply chain disruptions avoids value destruction [28]. Increased revenue, increased productivity, operational cost savings, lower Inventory, are some of the benefits from SCM system implementations [29].

Sample Selection Procedure and Data Description: Sarmayeh Gozari Bahman, Lizing Iran, Lizing Kgodrove Saipa and the Lizing Saneet Maeeden, Journal is our primary sources for collecting the sample of firms that have invested in ES. We started with the set of all announcements during 2003-2009 that mention ES providers by name. Although more than 75 providers are used in our search for SCM systems. These announcements mentioned firms that have invested in ES. To be included in the final sample a firm must have stock price information on the Center for Research on Security Prices (CRSP) database.

Our sample consists of 978 firms with the following breakdown: 558 announcements of investments in ERP systems, 420 in SCM systems. Furthermore, the size of firms that invest in SCM applications is larger than those that invest in ERP applications. This may be because SCM applications are relatively new compared to ERP applications. Our sample has two distinct sets of announcements. One set indicates that the firm has started or plans to start the implementation of an ES application. The other set indicates that the firm has completed the implementation of an ES application. Of the 556 ERP announcements, 105 are on completed implementations; of the 420 SCM announcements, 36 are on completed implementations.

MATERIALS AND METHODS

Our methodology including the period over which the performance effects are measured and the approach used to estimate the long-term stock price and profitability effects of investments in ES. In this study we focus on longer periods to the performance effects of ES. We examine the performance during the implementation period as well as the post-implementation period. Therefore, we use a two-year implementation period for ERP systems [9, 19, 23, 30]. Our discussion with an SCM expert at Lizing Kgodrove Saipa suggests that a 12-month implementation period seems reasonable. We choose a three-year post implementation period for ERP, SCM, applications. Overall, we examine the changes in financial performance over a three-year period for ERP systems (a one-year implementation period and a two- year post-implementation period) and a two year period for SCM systems (a one-year implementation period and a one-year post-implementation period). Methodology for estimating the long-term stock price effects we estimate the long-run buy-and-hold abnormal returns using daily returns. An abnormal return is the difference between the return on a stock and the return on an appropriate benchmark [7, 15, 16].

This discussion has focused on two issues. The first issue is the appropriate factors that should be controlled for in computing long-run abnormal returns. The second issue is the interpretation of the statistical significance of long-run abnormal returns [15, 16]. We implements this approach as follows:

- We identify the portfolio that a sample firm is assigned to in the first month of the start of the sample firm's measurement period. Since all other firms in this portfolio are similar to the sample firm on size, market-to-book ratio and prior performance, all these firms can be considered as benchmarks for the sample firm.
- In each month, all eligible firms are sorted according to their market value of equity and size portfolio. The smallest size portfolio is further divided into quintiles, resulting in 42 size portfolios. Each portfolio is further divided into quintiles according to their market-to-book ratio of equity, resulting in 210 portfolios. Each portfolio is further divided into 3 portfolios based on the stock price performance of firms in that portfolio over the previous year, resulting in 630 portfolios for each month where firms in each portfolio are similar in terms of size, market-to-book ratio and prior performance.
- A sample firm's abnormal return is the difference between its buy-and-hold return and the average of the buy-and-hold returns of all other firms that belong to the sample firm's portfolio [31].

- Statistical judgment is based on an imitation approach [15]. The idea is to compute an empirical distribution of abnormal returns for a portfolio and compare where the abnormal return of the sample portfolio falls on this distribution. To achieve this we create a fake-sample where for each sample firm we randomly select. This randomly selected firm is assigned the same announcement date as that of the sample firm. Once this is done for all sample firms, the mean abnormal performance for this pseudo-sample is computed using the portfolio approach discussed in Step 3. This results in one observation of the mean abnormal performance from a fake-sample.
- The distribution of the mean abnormal returns from 500 fake-portfolios is used to test whether the mean abnormal return for the sample portfolio is significantly different from zero. We compute the p-value as the bit of the 500 fake -samples with mean abnormal returns less than the mean abnormal return of the sample portfolio [15].

To estimate the profitability effects of investments in ES, we analyze changes in operating return on sale (ROS) and operating return on assets (ROA) which is the ratio of operating income to book value of total assets (sales). We focus on operating income over other income measures because it is a tool measure of performance as it is not hidden by specific items. To control for various factors unrelated to investments in ES that could affect the performance, we compare the performance of each sample firm against an appropriately chosen comparison group. We estimate abnormal performance as the change in the sample firm's performance minus the change in the median performance of the comparison group. More formally, let PIt1 and PIt2 be the performance level in year t1 and t2 (Where t2 > t1), respectively, for the sample firm I. Let PCt1 and PCt2 be the median performance level in year t1 and t2, respectively, for the comparison group for sample firm I. Then Lizing Kgodrove Saipa, the abnormal performance of sample firm I is.

$$API = (PIt2 - PIt1) - (PCt2 - PCt1)$$

Barber and Lyon [12] develop guidelines on selecting comparison groups that give well-specified test statistics. They emphasize the importance of selecting comparison groups that have similar prior performance as that of the sample firms as well as using a portfolio of firms as the comparison group. We implement the findings of Barber and Lyon [12] using a three-step procedure.

- For each sample firm we identify all firms that have the same three-digit SIC code as that of the sample firms and whose ROA (ROS) in the starting year of the measurement period is within 85-100% of the sample firm [32].
- If we do not find any firms in Step 1, then we attempt to match performance within the 85- 100% filter using all firms in the same one-digit SIC code.
- If we do not find any firms in Step 2, then we attempt to match performance within the 85- 100% without regard to SIC code. The mean (median) number of firms in the comparison groups is 60 (42) for the ERP sample, 51 (36) for the SCM sample. Our results show that, by the use of second comparison group, whose total assets are within a factor of 30 of the total assets of the sample firm. Abnormal performance can be reported as the change in the level of performance or as the percent change in the level of performance. The difference between these two methods in the level of ROA is 3%, whereas the percent change in ROA is 71.34%. If the ROA is negative, then percent change calculations are nonsensical.

Therefore, results on percent change require that we exclude firms (sample or comparison group firms) that have negative ROA. This can lead to biases in test statistics. Because of these issues with the percent change method, we report abnormal performance based on the change in the level of performance. To pool observations across time, for each firm in our sample, we translate calendar year to event years as follows. The year of the announcement date is year 0 in event year, the next year is year1 and year after that is year 2 and so on. For ERP systems (SCM systems) the implementation period spans years 0-1 and the post-implementation period spans years 2-3.

RESULTS

Table 1 presents results for the sample of firms that invested in ERP systems.During the one-year implementation period, the stock price performance of the sample firms relatively poor to the benchmark portfolios. The mean (median) abnormal return during this time period is -8.82% (-19.89%). A p-value of 0.058 indicates that the mean abnormal return is lower than the mean abnormal returns of 436 out of the 500 fake-portfolios abnormal returns. Of the 558 sample firms, only 45% of the sample firms do better than the median return of the firms which is significantly lower than 50% (p-value $\leq$ 0.01). The abnormal stock price performance

Table 1: Performance results for the sample of firms investing in ERP systems

Panel A

Performance measures	Implementation period (days 0-250)	Post-implementation period (days 251-500)	Implementation and Post-implementation period (days 0-500)
Number of observations	558	558	558
Mean abnormal return (%)	-8.82 (0.056)	7.97 (0.031)	-4.06 (0.37)
Median abnormal return (%)	-19.89	-0.98	-11.39
Percent of sample firms with returns greater than its portfolio median	39.78 (-2.79)"	48.05 (0.29)	51.21 (0.44)

Panel B

	Implementation period From years 0 to2				Post-implementation From years 2 to5				Implementation and Post-implementation From years 0 to5			
Performance measures	Observation	Mean	Median	Percent Positive	Observation	Mean	Median	Percent Positive	Observation	Mean	Median	Percent Positive
Abnormal change in the	558	1.01	0.56	56.45 (1.76)[c]	501	0.37	0.60	53.89 (1.01)	558	1.09	1.01	53.59 (2.05)[b]
558 level of return on assets		(1.74)[c]	(1.76)[c]			(0.52)	(0.81)			(1.53)	(2.49)[a]	
Abnormal change in the	558	0.58	0.36	53.22 (0.88)	501	0.31	1.04	57.48 (1.90)[c]	558	-0.15	0.67	56.98 (1.90)[c]
558 level of return on assets		(1.28)	(1.42)			(0.38)	(1.93)[c]			(-0.18)	(1.42)	

Panel A: Results on the mean abnormal stock return (p-value from the empirical distribution created from 500 replications of pseudo-portfolios in parenthesis). The median abnormal stock return and percent of sample firm with returns greater than the median return of the firms that belong to their assigned benchmark portfolios (the binomial sign test Z-static in parentheses)

Panel B: Results on abnormal return on assets and return on sales. T-statistic for the mean. Wilcoxon signed-rank test Z- statistic for the percent positive are reported in parentheses

[a]Significantly different from zero (50% in the case of percent positive) at the 1% level for one-tailed test

[b]Significantly different from zero (50% in the case of percent positive) at the 2.5% level for one-tailed test

[c]Significantly different from zero (50% in the case of percent positive) at the 5% level for one-tailed test

during the implementation period is negative and statistically significant. The results for the one-year post-implementation period are mixed. The mean abnormal return of 7.97% is statistically significant (p-value = 0.031). However, the median abnormal return is -0.98 %. Only 48.05% of the firms do better than the median return of the firms which is insignificantly different from 50%. Overall, only one of the three statistics suggests positive abnormal performance. When the performance is examined over the full three year period (the combined implementation and post implementation periods), there is no evidence of abnormal performance. The mean abnormal return is -4.06%, insignificantly different from zero (p value = 0.37). The median abnormal return is -8.39%. Nearly 51% of the sample firms do better than the median return of the firms which is insignificantly different from 50%. The result shows that over the three-year period, the stock price performance of firms that invest in ERP systems is no different from that of their benchmark portfolios. The results of Panel B Table 1 shows that the mean and median changes in ROA are positive for the implementation, post-implementation and the combined implementation and post-implementation periods. The positive changes in ROA during the implementation period are statistically significant at the 5% level. Although the changes in ROA during the post implementation period are positive, none of the changes are statistically significant. However, during the combined implementation and post-implementation periods the median change of 1.01% in ROA is significantly different from zero (p-value $\leq$ 0.01) and nearly 54% of the sample firms positive abnormal change in ROA, significantly different from 50% (p-value $\leq$ 0.025). The results show that ERP adopters show an improvement in ROA. When ROS is used as the performance metrics, eight of the nine performance metrics (three for each time period) are positive but only three changes are statistically significant at the 5% level. These are the median change during the post-implementation period, the percent of sample firms that positive abnormal change during the post-implementation period and the percent of sample firms that positive abnormal change during the combined implementation and post-implementation periods. Although results show some positive abnormal changes in ROS and are not as strong as that of the changes in ROA. Overall results show that firms that invests in ERP systems is not statistically significant increase in stock returns; there is some evidence to suggest that profitability improves over the combined implementation and post-implementation periods. To examine the ERP results in more detail, we segment the sample into four different subsamples.

To estimate the effect of ERP systems during the post-implementation period we examine the results only for those announcements that indicated that the firm has completed the implementation of an ERP system. We also examine the results for those announcements that indicated that the firm has started or planned to start the

implementation of an ERP system. By examining the performance of these firms over the three-year period we look on the payback from ERP systems over a three-year period. We also divide our sample into manufacturing and service firms to see if the benefits from investments in ERP systems are more or less for manufacturing or service firms. We did not find any differences between them for manufacturing or service firms. Table 2 shows results for the sample of firms that invested in SCM systems. During the one-year implementation period, the mean abnormal return is -1.12%, insignificantly different from zero (p value = 0.421). The median abnormal return is -5.65%. Of the 420 sample firms, about 40% of the sample firms did better than the median return of the firms which is insignificantly different from 50%. Basically, the abnormal stock price performance during the implementation period is not statistically significant. During the post implementation period the mean abnormal return of 14.06% is statistically significant (p value = 0.012). However, the median abnormal return is -2.85%. Nearly 47% of the firms do better than the median return of the firms which is insignificantly different from 50%. Over the full two-year period, the mean abnormal return of 14.32% is statistically significant at the 5% level. The median is -6.82%. Overall, there is some evidence of positive abnormal stock price performance during the two-year period.

The results for the accounting metrics (Panel B of Table 2) provide strong support that firms that invest in SCM systems show improvements in ROA and ROS which is positive and statistically significant at the 1.5% level or better. The results for the combined implementation and post-implementation periods indicate that the median change in the level of ROA is 1.12%. The median change in the level of ROS is 1.08%. Both these changes are statistically significant (p-value $\leq$ 0.01). More than50% of the sample firms experience positive abnormal changes in ROA and ROS during the combined implementation and post-implementation periods. All the results show that are statistically significant at the 1% level or better. Overall the results indicate that investments in SCM systems improved profitability. We also divide the SCM announcements sample into those made by manufacturing firms (about 70% of the sample). The results for this subsample are consistent with the results for the full sample. Moreover we need to address an important issue it is plausible that the some of the insignificant results that we find with respect to ES systems are because the controls have adopted ES systems. Therefore we cannot claim that all firms in our control set have not implemented ES. We believe that the chances are low that our results that a subset of control firms may have implemented ES. First, our sample has 978 ERP, SCM announcements. Anyhow more than 3000 firms are publicly traded; our control firms will come from a sample of more than 3000 firms. If most of these firms have adopted ES, then one would be very much concerned about our results. While most of the controls have ES are quite low. Furthermore, given that our last announcement is in 2009, the adoption rate among controls in 2009 is likely to be much lower than today. Second, even if some of the 3000 control firms have adopted ES, it should not have much of an impact on our stock price performance results because of the method used to create the 500 fake-samples. In each fake-sample we use size, prior performance, to select 978 firms from the sample of more than 3000 firms. We then compare the results of the sample firms against the results of these 500 fake-samples. If each of these 500 fake-samples is influenced by control firms that have implemented ES then our results would be a source of concern. While this could happen in a few of the fake-samples, the chances of the most fake samples are very low as process of creating the fake samples is quite randomized. Third, in analyzing the performance effect of ES on ROA and ROS, we match each sample firm to a comparison group that consists of firms from the same industry and which have similar performance characteristics. On average each comparison group consists of 60 firms. Furthermore, we estimate abnormal performance relative to the change in the median performance of the comparison group. The median of the comparison group is less likely to be impacted by non-identified ES adopters. Finally, we note that our sample is based on firms that have started their implementation between 2003 and 2009. At least in the case of SCM system our sample is likely to have firms that are early adopters, which minimizes the chances that the control firms may have also implemented SCM system. The above discussion provides some rationale of why the chances are low that our results are impacted by controls that have also implemented ES. Table 4 indicates that abnormal stock price performance results of early adopters are not that different from the overall sample. The abnormal return during the implementation period is negative and is positive during the post implementation period. However, the mean abnormal returns over the implementation and post-implementation periods are insignificantly different from zero. Panel B of Table 3 appears to be stronger than the results for the full ERP sample (Panel B of Table 1). Over the combined

Table 2: Performance results for the sample of firms investing in SCM systems

Panel A

Performance measures	Implementation period (days 0-125)	Post-implementation period (days 126-500)	Implementation and Post-implementation period (days 0-500)
Number of bservations	420	420	420
Mean abnormal return (%)	-1.12 (0.421)	14.06 (0.012)	14.32 (0.068)
Median abnormal return (%)	-5.65	-2.85	-6.82
Percent of sample firms with returns greater than its portfolio median	40.25 (-1.01)	47.30 (0.34)	50.00 (0.00)

Panel B

	Implementation period From years 0 to1				Post-implementation From years 1 to 2				Implementation and Post-implementation From years 0 to2			
Performance measures	Observation	Mean	Median	Percent Positive	Observation	Mean	Median	Percent Positive	Observation	Mean	Median	Percent Positive
Abnormal change in the	423	0.95	0.76	60.99 (2.61)[a]	390	1.58	1.58	59.23 (2.10)[b]	423	2.98	1.12	60.99 (2.61)[a]
186 level of return on assets		(2.18)[b]	(2.61)[a]			(2.35)[a]	(4.31)[a]			(4.31)[a]	(3.59)[a]	
Abnormal change in the	423	0.65	0.58	59.57 (2.27)[b]	393	0.43	0.43	57.69 (1.75)[c]	423	1.33	1.08	62.41 (2.95)[a]
186 level of return on assets		(1.80)[c]	(1.50)[a]			(0.77)	(1.75)[c]			(-0.18)[a]	(2.78)[a]	

Panel A: Results on the mean abnormal stock return (p-value from the empirical distribution created from 500 replications of pseudo-portfolios in parenthesis). The median abnormal stock return and percent of sample firm with returns greater than the median return of the firms that belong to their assigned benchmark portfolios (the binomial sign test Z-static in parentheses)

Panel B: Results on abnormal return on assets and return on sales. T-statistic for the mean. Wilcoxon signed-rank test Z- statistic for the percent positive are reported in parentheses

[a] Significantly different from zero (50% in the case of percent positive) at the 1% level for one-tailed test

[b] Significantly different from zero (50% in the case of percent positive) at the 2.5% level for one-tailed test

[c] Significantly different from zero (50% in the case of percent positive) at the 5% level for one-tailed test

Table 3: Performance results for the early adopters (1997 and before) ERP systems

Panel A

Performance measures	Implementation period (days 0-250)	Post-implementation period (days 251-500)	Implementation and Post-implementation period (days 0-500)
Number of bservations	312	312	312
Mean abnormal return (%)	-6.48 (0.167)	14.99 (0.075)	-1.82 (0.36)
Median abnormal return (%)	-16.46	0.23	-13.43
Percent of sample firms with returns greater than its portfolio median	40.8 (-2.04)[c]	52.88 (0.58)	52.88 (0.87)

Panel B

	Implementation period From years 0 to1				Post-implementation From years 1 to 2				Implementation and Post-implementation From years 0 to2			
Performance measures	Observation	Mean	Median	Percent Positive	Observation	Mean	Median	Percent Positive	Observation	Mean	Median	Percent Positive
Abnormal change in the	330	1.16	0.45	54.54 (0.95)	306	0.47	1.51	59.80 (2.27)[b]	330	1.55	1.51	60.91 (2.27)[b]
558 level of return on assets		(1.60)	(1.51)			(0.51)	(1.25)			(1.59)	(2.51)[a]	
Abnormal change in the	330	1.43	0.66	55.45 (1.14)	306	0.80	1.74	64.71 (2.97)[a]	330	-0.28	1.75	60.91 (2.27)[b]
558 level of return on assets		(1.78)[c]	(1.78)[c]			(0.52)	(2.97)[a]			(-0.19)	(2.08)[b]	

Panel A: Results on the mean abnormal stock return (p-value from the empirical distribution created from 500 replications of pseudo-portfolios in parenthesis). The median abnormal stock return and percent of sample firm with returns greater than the median return of the firms that belong to their assigned benchmark portfolios (the binomial sign test Z-static in parentheses)

Panel B: Results on abnormal return on assets and return on sales. T-statistic for the mean. Wilcoxon signed-rank test Z- statistic for the percent positive are reported in parentheses

[a] Significantly different from zero (50% in the case of percent positive) at the 1% level for one-tailed test

[b] Significantly different from zero (50% in the case of percent positive) at the 2.5% level for one-tailed test

[c] Significantly different from zero (50% in the case of percent positive) at the 5% level for one-tailed test

implementation and post implementation periods, the improvements in ROA and ROS are positive and statistically significant which is stronger than what was observed for the full ERP sample. Consistent with the results for the full sample, there is poor evidence of improvements in profitability during the implementation period. The evidence of Table 3 suggests that early adopters may have benefited more from ERP implementation when compared to later adopters.

Result and Future Research: Our analysis show a mixed results that examining the financial impact of IT investments led some to propose a ‘‘productivity paradox’’. Brynjolfsson and Hitt [33] and Kohli and Devaraj [34] suggest that often the financial value of large systems was hidden is not sufficient. Some of the research issues are not clear such as: (1) the choice of the performance metrics [35], (2) the time period studied [36], (3) the method of analysis [37]. In the case of adopters of

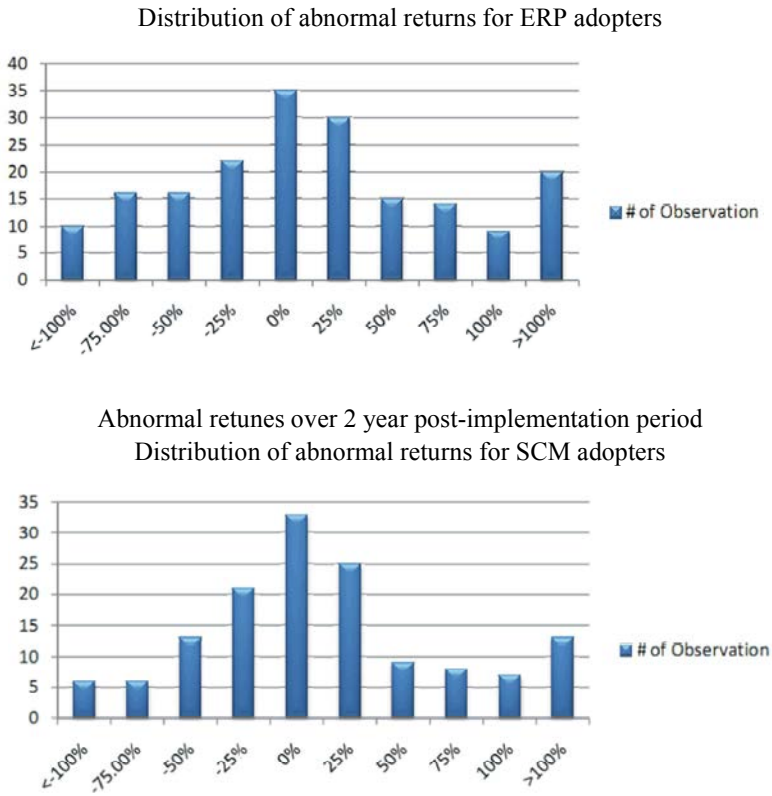

Fig. 1: Distribution of post-implementation period abnormal returns for ERP, SCM, samples

ERP systems, we find some evidence of improvements in profitability but not in stock returns. The results for improvements in profitability are stronger in the case of early adopters of ERP systems. Although our results are not uniformly positive across the different ES systems, we do not find evidence of negative performance associated with ES adoption. Our results also add to the emerging literature on information technology and productivity. The use of both accounting data and stock returns we analyze data over a two-year or three-year period to get the long-term impact of ES adoption and our estimation procedures show that abnormal performance is strongly measured and that the associated statistical tests are well specified. However, in using stock price and accounting data, we are not able to examine internal firm mediating factors that may influence the financial value from ES. The linkage between internal capability factors and financial performance is not always clear. The resource-based view (RBV) provides a theoretical framework for evaluating the types of internal capabilities that provide a competitive advantage that can in turn lead to improvements in financial performance [38-40]. The decisions made during the adoption process are likely to differ across firms [41], which implies that the outcomes may also differ. Several studies suggest that internal organizational capabilities could influence the direction and extent of financial benefits from ES adoption [42-45]. The analysis suggests that future research should explore the relationship between internal organizational capabilities and financial performance. The abnormal stock price performance results presented in Tables 1 have mean values that are generally higher than the median values. This suggests that some firms are achieving high returns from their ES investments. Additional support for this explanation is provided by Fig. 1, which shows the distribution of abnormal stock returns during the one-year post-implementation period for our three ES samples. In the case of the ERP adopters, nearly 60 out of 558 sample firms have abnormal returns greater than 100%. The conclusions based on a small sample, shows that these 60 firms may represent firms that are best able to develop the requisite internal capabilities during ES adoption. The performance improvements reported by such firms that they can achieve similar results by purchasing ES, even though they lack the internal capabilities needed to fully leverage the potential of these systems. Existing OM research in the area of ES has primarily focused on key factors for successful implementation

[8] and the operational benefits, such as faster transaction processing and customer response, obtained from the use of these systems [18]. Stratman [9] found that ERP users with high ERP competence are more likely to experience a performance improvement from ERP adoption. Somers and Nelson [46] also look beyond implementation issues to assess the fit between ERP capabilities and organizational strategies and integration mechanisms. We report the financial impact by the average firm adopting ES. Although we do not capture details of individual firm implementation success or failure, it is likely that our sample includes some firms which had implementation difficulties or failed implementations. Our approach allows us to assess the overall benefits and risks faced by a typical firm planning to adopt ES. This study combines secondary and primary data might provide a clearer picture of how ES influence operational and in turn financial performance. Primary data sources could be used to determine precise implementation timelines, as well as to collect information on specific operational practices that leverage the capabilities of ES.

REFERENCES

1. Khari, Ali and Siavashan, Farangis. 2011. Measuring the Effect of Management Factors on the Performance of Dairy Manufacturing Companies in Golestan Province, World Applied Sciences J., 15(5): 708-716.
2. Kamyabi, Yahya. and Devi, Susela. 2011. The Impact of Accounting Outsourcing on Iranian SME Performance:Transaction Cost Economics and Resource-Based Perspectives, World Applied Sciences J., 15(2): 244-252.
3. Dehning, B., V.J. Richardson, 2002. Returns on investments in information technology: a research synthesis. J. Information Systems, 16(1): 7-30.
4. Chatterjee, D., C. Pacini and V. Sambamurthy, 2002. Stock market reactions to IT infrastructure investments: an event study analysis. J. Management Information Systems, 19(2): 7-42.
5. Hayes, D.C., J.E. Hunton and J.L. Reck, 2001. Market reaction to ERP implementation announcements. J. Information Systems, 15(1): 3-18.
6. Ranganathan, C. and I. Samarah, 2003. Enterprise resource planning systems and firm value: an event study analysis. Working Paper University of Illinois at Chicago, Chicago.
7. Fama, E.F., 1998. Market efficiency, long-term returns and behavioral finance. J. Financial Economics, 49: 283-306.
8. Mabert,V.A., A.K. Soni and M.A. Venkataramanan, 2003. The impact of organization size on enterprise resource planning (ERP) implementations in the US manufacturing sector. OMEGA 31: 235-246.
9. Stratman, J.K., 2001. Information integration for supply chain management: an empirical investigation of ERP systems in manufacturing. Ph.D. Dissertation, University of North Carolina, Chappel Hill, NC, Unpublished.
10. Hunton, J.E., R.A. McEwen and B. Wier, 2002. The reaction of financial analysts to enterprise resource planning (ERP) implementation plans. J. Information Systems, 16(1): 31-40.
11. Hitt, L.M., D.J. Wu and X. Zhou, 2002. Investment in enterprise resources planning. J. Management Information Systems, 19: 71-98.
12. Barber B.M. and J.D. Lyon, 1996. Detecting abnormal operating performance: the empirical power and specification of test statistics. Journal of Financial Economics, 41: 359-399.
13. Dehning, B., V.J. Richardson and R.W. Zmud, 2004. The financial performance effects of IT-based Supply Chain Management Systems in Manufacturing Firms.
14. Poston, R. and S. Grabski, 2001. The financial impacts of enterprise resource planning implementations. International J. Accounting Information Systems, 2: 271-294.
15. Lyon, J.D., B.M. Barber and C. Tsai, 1999. Improved methods for tests of long-run abnormal stock returns. J. Finance, 54: 165-201.
16. Kothari, S.P. and J.B. Warner, 1997. Measuring long-horizon security price performance. J. Financial Economicsm, 43: 301-339.
17. Cotteleer, M. and E. Bendoly, 2006. Order lead-time improvement following enterprise-IT implementation: an empirical study. MIS Quarterly, 30: 3.
18. McAfee, A., 2002. The impact of enterprise information technology adoption on operational performance: an empirical investigation. Production and Operations Manage., 11(1): 33-53.
19. Mabert, V.A., A.K. Soni and M.A. Venkataramanan, 2000. Enterprise resource planning survey of US manufacturing firms. Production and Inventory Management J., 41(20): 52-58.
20. Scott, J.E. and I. Vessey, 2000. Implementing enterprise resource planning systems: the role of learning from failure. Information Systems Frontiers, 2(2): 213-232.
21. McAfee, A. and D. Upton, 1996. Vandelay Industries. Harvard Business School Case #9-697-037. Harvard Business School Publishing, Boston, MA.

22. Kearney, A.T., 2000. Information Technology Monograph: Strategic Information Technology and the CEO Agenda. AT Kearney, Chicago, IL.
23. Boston Consulting Group, 2000. Creating Value from Enterprise Initiatives: A Survey of Executives. Boston Consulting Group, Boston, MA.
24. Anvari, Alireza. Hojjati, Seyed mohammad hossein and Ismail, yusof. 2011, Performance Measurement System Through Supply Chain Management to Lean Manufactoring, World Applied Sciences J., 14(2): 285-292.
25. Raman, A. and J. Singh, 1998. i2 Technologies. Harvard Business School Case #9-699-042. Harvard Business School Publishing Boston, MA.
26. Cheung, K.L. and H.L. Lee, 2002. The inventory benefit of shipment coordination and stock rebalancing in a supply chain. Management Sci., 48(3): 300-306.
27. Milner, J.M. and P. Kouvelis, 2002. On the complementary value of accurate demand information and production and supplier flexibility. Manufacturing and Service Operations Manage., 4: 99-113.
28. Hendricks, K.B. and V.R. Singhal, 2003. The effect of supply chain glitches on shareholder value. J. Operations Manage., 21: 501-522.
29. Nucleus Research, 2003a. The real ROI from i2 supply chain management. Nucleus Research Note D11, Wellesley, MA.
30. O'Leary, D., 2000. Enterprise Resource Planning Systems, Life Cycle, Electronic Commerce and Risk. Cambridge University Press, New York.
31. Hendricks, K.B. and V.R. Singhal, 2005. An empirical analysis of the effect of supply chain disruptions on long-run stock price performance and risk of the firm. Production and Operations Manage., 14: 35-52.
32. Hendricks, K.B., V.R. Singhal and J.K. Stratman, 2007. The impact of enterprise systems on corporate performance. J. Operations Manage., 25: 65-82.
33. Brynjolfsson, E. and L. Hitt, 1996. Paradox lost? Firm level evidence on the returns to information systems spending. Management Sci., 42(4): 541-558.
34. Kohli, R. and S. Devaraj, 2003. Measuring information technology payoff a meta-analysis of structural variables in firm level empirical research. Information Systems Res., 14(2): 127-145.
35. Bharadwaj, A., S. Bharadwaj and B.R. Konsynski, 1999. Information technology effects on firm performance as measured by Tobin's Q. Management Sci., 45(7): 1008-1024.
36. Devaraj, S. and R. Kohli, 2000. Performance impacts of information technology: is actual usage the missing link? Management Sci., 49(3): 273-289.
37. Robey, D. and M.C. Boudreau, 1999. Accounting for the contradictory organizational consequences of information technology: theoretical directions and methodological implications. Information Systems Res., 10(2): 167-185.
38. Peteraf, M.A., 1993. The cornerstones of competitive advantage: a resource based view. Strategic Management J., 14(3): 179-191.
39. Wernerfelt, B., 1984. A resource -based view of the firm. Strategic Management J., 5(2): 171-180.
40. Wernerfelt, B., 1995. The resource-based view of the firm: ten years after. Strategic Management J., 16(2): 171-174.
41. Adner, R. and C.E. Helfat, 2003. Corporate effects and dynamic managerial capabilities. Strategic Management J., 24: 1011-1025.
42. Boudreau, M.C. and D. Robey, 2005. Enacting integrated information technology: a human agency perspective. Organization Sci., 16(1): 3-18.
43. Brynjolfsson, E., L. Hitt and S. Yang, 2002. Intangible assets: computers and organizational capital. Brookings Papers on Economic Activity, 1: 137-182.
44. Melville, N., K. Kraemer and V. Gurbaxani, 2004. Review: information technology and organizational performance: an integrative model of IT business value. MIS Quarterly, 28(2): 283-322.
45. Powell, T.C. and A. Dent-Micallef, 1997. Information technology as competitive advantage: the role of human, business and technology resources. Strategic Management J., 18(5): 375-405.
46. Somers, T.M. and K.G. Nelson, 2003. The impact of strategy and integration mechanisms on enterprise system value: empirical evidence from manufacturing firms. European J. Operational Res., 146: 315-338.