

**RESEARCH NOTE**

# Evaluating E-Business Leadership and its Links to Firm Performance

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**ABSTRACT**

*Electronic business (e-business) has been popularly lauded as “new economy.” As a result, firms are prompted to invest heavily in e-business related activities such as supplier/procurement and online exchanges. Whether the investments have actually paid off for the firms remain largely unknown. Using the data on the top 100 e-business leaders compiled by InternetWeek, the leaders are compared with their comparable counterparts in terms of profitability and cost in both the short-run and long-run. It is found that while the leaders have superior performance based on most of the profitability measurements, such superiority is not observed when cost measurements are used. Based on the findings, managerial implications are offered accordingly.*

*Keywords: competitive advantage; cost; e-business; e-commerce; profitability; superior performance*

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**INTRODUCTION**

The rapid expansion of e-business witnessed in the late 1990s was nothing short of a spectacle. It seemed that almost everyone was talking about it, and every firm was eager to invest in it, hoping to take away a slice of the pie. Andy Grove, chairman of Intel Corp, stated in 1998: “Within 5 years, all companies will be Internet companies or they would not be companies” (Intel, 2000). Merely mentioning of the “e” word could mean multi-million dollars. The case at hand was Zapata Corp., a fish oil processing company, co-founded by former U.S. President George H. W. Bush. The company announced on December 23, 1998 that it would transform

itself into an Internet portal to compete with Yahoo!, Lycos, and alike. Immediately following the announcement, Zapata’s stock price skyrocketed nearly 100% from 7.19 to 14.25 with trading volume at more than 2,000% higher than normal, according to Yahoo! Finance. Academic researchers rushed in and concluded that “a new economy was born.”

The potential benefits of e-business are well documented by academic researchers and practitioners alike (InternetWeek, 2000/2001; Phan, 2003). Organizations that integrate e-business applications, such as shared online database and Internet-based reporting in their business processes, can lead to reduced cost,

increased efficiency and profitability, and better customer relationship management. Perhaps one of the most significant contributions of e-business applications is its abilities to directly bring sellers and buyers together with little middleman's interventions.

Although the advantages of e-business exist in theory, little empirical work has been done to confirm them. Some study actually showed an inconclusive link between e-business and sustainable development (Digital Europe, 2003):

*Our survey showed no conclusive evidence for companies that use a lot of e-business actually performing better than other companies on sustainable development, simply by virtue of their e-business use. There may be a relationship here—which could become more obvious as e-business applications are more fully integrated into companies' operations—but more research would be needed to prove a link.*

Answering this call, researchers have attempted to build theoretical frameworks to pinpoint how e-business creates value. Using the technology-organization-environment (TOE) framework Zhu, Kraemer, Xu, and Dedrick (2004) found that technology readiness, firm size, global scope, financial resources, competition intensity, and regulatory environment may affect e-business value creation. Amit and Zott (2001) integrated several theoretical perspectives on entrepreneurship and strategic management to identify four interdependent dimensions: efficiency, complementarities, lock-in, and novelty as sources of value creation.

Despite the recent advancement of research in this area, the fundamental question regarding e-business remains unanswered, that is, whether e-business creates value. This article attempts to fill this vacuum by establishing a theoretical foundation to evaluating the linkage between e-business investments and firm performance in terms of profitability and cost savings. Confirmation or disconfirmation of the effectiveness of firms' investments in e-business will contribute to the knowledge accumulation

in this area. It can also provide an insight for future investments.

The article begins by presenting the research framework grounded in the resource-based view (Barney, 1986; Barney, 1991; Conner, 1991; Rumelt, 1984). Resource-based view argues that firm-specific skills and resources that are rare and difficult to imitate or substitute are the main drivers of firm performance. How e-business initiatives create unique skills and resources for firms is shown. The hypotheses are then formulated, the data set and methodology discussed, and estimation results presented. Finally, discussion of the results and suggestions for future research are provided.

## RESEARCH FRAMEWORK: THE RESOURCE-BASED VIEW

Broadly speaking, e-business value is a subset of the business value of IT. The business value of IT investments in general has been long debated, which led to the birth of the famous term "productivity paradox." Some studies provide positive support for the business value of computer investments (Brynjolfsson, 1993; Brynjolfsson & Hitt, 1996; Hitt & Brynjolfsson, 1996; Bharadwaj, 2000; Stratopoulos & Dehning, 2000). On the other hand, Strassmann (1997) argues that IT investments have no discernible effects on firm profitability measured in return on assets (ROA), return on equity (ROE), and economic value added (EVA).

In an attempt to explain the inconclusiveness, some researchers propose several theoretical models that examine the entire process needed for IT investments to make an impact on business value (Lucas, 1993; Markus & Soh, 1993). One of the dominant views is the resource-based view (RBV). Based on this view, IT investment itself does not provide any sustainable value because competitors can easily duplicate the investment by purchasing the same hardware and software. Rather, competitive advantages are derived from the manner in which firms deploy IT to generate a unique set of resources and skills that are difficult to duplicate (Clemons, 1986, 1991; Clemons & Row, 1991; Mata, Fuerst, & Barney, 1995). This type

of resources is firm specific, rare, imperfectly imitable, and not strategically substitutable by others create competitive advantages for firms (Barney, 1991). Grant (1991) extends the RBV by linking resources to organizational capabilities. Firms generate organizational capabilities by optimally assembling their resources. When these capacities are embedded in organizational processes, it makes firms deploy resources more effectively and efficiently than its competitors. In turn, competitive advantages are created.

Adopting this RBV, one can see that IT investments themselves do not necessarily generate sustained value because competitors can easily duplicate the action by investing in the same or equivalent hardware and software. In order to achieve competitive advantages of IT investments, firms must leverage their investments (resources) to create unique capacities that impact their overall effectiveness.

## E-BUSINESS AND COMPETITIVE ADVANTAGE

Information systems researchers have classified key IT-based resources into three categories: (1) the physical IT infrastructure (the tangible resources), (2) the technical and managerial IT skills (the human resources), and (3) the intangible resources such as knowledge base, customer relations, and synergy (Bharadwaj, 2000; Grant, 1995). To be successful, e-business based firms need to invest in a new type of IT infrastructure that can provide real time responses 24/7 to customer inquiries. Some emerging infrastructures include XML, server farms, and dynamic storage. In addition, to protect the infrastructures and ensure the integrity of information, firms need to heavily invest in security. All these require IT and management staff to possess necessary skills for managing the new working environment. This allows the firms to acquire unique, rare and firm specific technical and managerial skills. With the infrastructure and management skills in place, the firms can manage their knowledge base better and create synergies between different working units. In the process, they can become truly customer oriented. Therefore, from the

resource-based perspective, e-business initiatives help firms to obtain competitive advantage in the marketplace.

In this article, competitive advantages in terms of either higher profit or lower cost are measured. As a result, the following hypotheses are proposed:

**H<sub>1</sub>:** *The average profit ratios of the e-business leader firms are higher than those of the non-leaders.*

**H<sub>2</sub>:** *The average cost ratios of the e-business leader firms are lower than those of the non-leaders.*

## METHODOLOGY

The “matched sample comparison group” method, which has been extensively used in previous research (Bharadwaj, 2000; Strato-poulos & Dehning, 2000) is adopted. In this methodology, there are two samples: the first sample is a treatment group and the second is a carefully selected control group that is matched to the treatment group by size and type. Then the levels of interest variables of these two samples are compared. In this case, the treatment group consists of the firms identified by the industry as e-business leaders while the control group consists of the matched firms in terms of size and type.

## Dataset

In 2000 and 2001 InternetWeek published a special issue, InternetWeek 100, in which 100 e-business leaders were identified for their effectiveness in using the Internet to achieve tangible business benefits (InternetWeek, 2000/2001). They were evaluated based on their e-business participation in customer-oriented activities, supplier/procurement activities, electronic marketplace, integration of front- and back-end systems, revenue growth, and cost cutting efforts.

In order to obtain a consistent sample, the selection of the companies that were identified as leaders in both years was restricted. In addition, firms must have complete financial

data on Compustat for the period of 1999 to 2002. This process led to 46 companies in the treatment sample.

For the control sample, it was first specified that a matching firm must be in the same industry as the leader based on the 4-digit primary SIC. Second, the average sales of the matching firm must be within 70% to 130% of the leader firm's. When there were multiple matches, the firm with 5 year average sales closest to that of the leader firm was selected. If a match could not be identified in this fashion, then the 4-digit SIC matching rule was relaxed to three- or two-digit SIC. This procedure has been used by

previous studies such as Bharadwaj (2000) and Barber and Lyon (1996). Firms in both groups are listed in the Appendix.

Table 1 provides the descriptive statistics for the two groups. The t-test does not reveal any systematic differences between them in terms of size measures such as sales, total assets, and number of employees.

Two categories of variables are collected for both treatment and control samples to test the aforementioned two hypotheses related to profit and cost. Five profit ratios include return on assets (ROA), return on sales (ROS), operating income to assets (OI/A), operating

Table 1. Descriptive statistics

1999	E-Business Leaders		Control Sample		Difference of Means
	Mean	Median	Mean	Median	T
Sales (billion \$)	20.84	11.27	18.56	10.28	1.326
Assets (billion \$)	45.61	16.54	35.72	12.74	1.103
Number of Employees	82348	45504	120931	54450	-0.859

  

2000	E-Business Leaders		Control Sample		Difference of Means
	Mean	Median	Mean	Median	T
Sales (billion \$)	23.05	12.26	20.78	11.42	1.207
Assets (billion \$)	57.17	20.49	41.96	13.02	1.474
Number of Employees	89888	44000	121425	46546	-0.900

  

2001	E-Business Leaders		Control Sample		Difference of Means
	Mean	Median	Mean	Median	T
Sales (billion \$)	21.69	12.81	20.72	11.33	0.531
Assets (billion \$)	56.52	20.25	44.80	13.71	1.115
Number of Employees	85435	46800	121199	62175	-1.175

  

2002	E-Business Leaders		Control Sample		Difference of Means
	Mean	Median	Mean	Median	T
Sales (billion \$)	21.66	11.92	20.38	11.45	0.605
Assets (billion \$)	59.08	19.50	48.47	13.79	0.922
Number of Employees	83961	47480	101336	44323	-1.315

income to sales (OI/S), and operating income to employee (OI/E). Three cost ratios are total operating expenses to sales (OEXP/S), cost of goods sold to sales (COGS/S), and selling and general administrative expenses to sales (SG&A/S). Total operating expenses are defined as the sum of COGS and SG&A. The rationale for those variables can be found in Bharadwaj (2000).

### Statistical Tests and Outliers

The primary interest is to test the hypotheses that the mean levels of operational performance variables of e-business leaders are better than those of non-leader firms. Traditional standard t-test would be used for this purpose. However, since the distributions of financial ratios, such as the variables defined, tend to be non-normal, skewed and fat tailed, non-parametric test is preferred (Bharadwaj, 2000; Stratopoulos & Dehning, 2000). In this article, the Wilcoxon signed rank test is used.

Another characteristic of financial data is that there are a significant number of outliers.

As a data treatment, a methodology suggested by Stratopoulos and Dehning (2000) was followed by removing those data points that fall more than 1.5 times the interquartile range above the third quartile or below the first.

## RESULTS AND DISCUSSION

Table 2 provides the one-sided Wilcoxon signed rank results for the aforementioned profitability related variables between e-business leaders and control sample from 1999 and 2002. E-business leaders performed better in terms of all measures but one (OIE) in 1999, the year before they were identified as e-business leaders. This indicates that financial performance was one of the considerations for their selections. Most of the advantages were maintained in 2000, except for ROA, while the leaders now performed better based on the OIE measurement. In 2001, however, there were no significant differences between the leaders and matched firms in all financial variables. In the last year of the sample, e-business leaders performed better than the control sample in terms of three out of five

Table 2. E-business and profitability

	1999			2000			2001			2002		
	Mean	Median	Pr>Z	Mean	Median	Pr>Z	Mean	Median	Pr>Z	Mean	Median	Pr>Z
ROA-leaders	5.145	4.508	0.06 <sup>c</sup>	5.327	3.810	0.31	2.789	1.659	0.22	3.126	2.892	0.02 <sup>b</sup>
ROA-control	3.876	2.726		4.067	3.457		1.452	1.513		1.384	2.031	
ROS-leaders	0.076	0.067	0.01 <sup>a</sup>	0.066	0.070	0.04 <sup>b</sup>	0.052	0.043	0.10 <sup>c</sup>	0.029	0.032	0.49
ROS-control	0.051	0.045		0.052	0.049		0.020	0.032		0.021	0.032	
OIA-leaders	0.112	0.092	0.02 <sup>b</sup>	0.097	0.089	0.02 <sup>b</sup>	0.076	0.064	0.12	0.068	0.069	0.02 <sup>b</sup>
OIA-control	0.085	0.068		0.067	0.064		0.059	0.049		0.045	0.046	
OIS-leaders	0.136	0.121	0.01 <sup>b</sup>	0.132	0.121	0.01 <sup>a</sup>	0.088	0.079	0.32	0.096	0.104	0.05 <sup>b</sup>
OIS-control	0.104	0.089		0.095	0.085		0.092	0.068		0.074	0.069	
OIE-leaders	0.033	0.025	0.18	0.042	0.032	0.01 <sup>a</sup>	0.028	0.023	0.21	0.027	0.021	0.33
OIE-control	0.027	0.018		0.024	0.016		0.023	0.011		0.021	0.014	

Notes:

<sup>a</sup>1% level, <sup>b</sup> 5% level, <sup>c</sup> 10% level

ROA—return on assets; ROS—return on sales; OIA—operating income to assets; OIS—operating income to sales; OIE—operating income to employees.

financial ratios. Based on the discussion, it can be concluded that overall, the hypothesis #1 is partially supported.

Table 3 provides the one-sided Wilcoxon signed rank test results for the aforementioned cost related variables between the e-business leaders and the control sample from 1999 and 2002. Throughout all these years there were no significant differences between the leaders and the matched firms. This finding is largely consistent with other studies such as Bharadwaj (2000) and Mitra and Chaya (1996). Based on the results, it is concluded that the hypothesis #2 is not supported.

## CONCLUSION

As businesses rushed to invest in the “new” economy, pressured by either the thinking of a paradigm shift or peers during the Internet boom, the payoff of such investments was not as important as making the move or taking action. Now that the bubble has burst, companies are forced to focus once again to justifying their IT investment decisions. This study aims to provide an assessment whether the investments made in e-business during the boom period had actually paid off in terms of profitability and cost in both short- and long-runs. Using the e-business leaders identified by InternetWeek, a control sample that matched the leaders based

on industry type and size was created. The performances, measured in profit and cost, of these two groups were compared using the Wilcoxon signed rank non-parameter test. The results indicate that in terms of profitability, e-business leaders performed better than the control sample in the long-run but the superior performance fluctuated in the short-run. In terms of cost, there were no significant differences between the leaders and the control sample in both the short- and long-runs. The combination of leaders’ higher profitability than and the same cost measures as the firms in the control sample is consistent with the observation by Bharadwaj (2000) that “IT leaders do not necessarily have a cost focus, but tend to exploit IT for generating superior revenues.”

Based on the findings in this study, it is suggested that management should be very clear about the time horizon of the e-business, or IT in general, investments. The findings of this study demonstrate that the consistent superior financial performances of the e-business leaders are only observed in the long-run. In reality, management often fails to see the long-run benefits from new IT investments due to the cost concerns of new IT in the short-run. Dehning, Richardson, and Stratopoulos (2005) suggest that management should take a long-term view because IT might allow a firm to form

Table 3. E-business and cost

	1999			2000			2001			2002		
	Mean	Median	Pr>Z	Mean	Median	Pr>Z	Mean	Median	Pr>Z	Mean	Median	Pr>Z
COG/S-leaders	0.650	0.699	0.49	0.638	0.683	0.42	0.690	0.708	0.80	0.656	0.659	0.46
COG/S-control	0.653	0.669		0.644	0.650		0.670	0.683		0.679	0.683	
SGA/S-leaders	0.230	0.228	0.37	0.236	0.233	0.49	0.245	0.232	0.59	0.240	0.224	0.32
SGA/S-control	0.237	0.214		0.236	0.238		0.243	0.237		0.254	0.230	
OPEXP/S-leaders	1.086	0.788	0.13	1.227	0.952	0.33	1.208	0.956	0.25	1.263	1.238	0.22
OPEXP/S-control	1.223	1.301		1.175	1.234		1.229	1.316		0.909	1.315	

Notes:

COG/S—cost of goods sold to sales; SGA/S—selling and general administration expense to sales; OPEXP/S—operating expenses to sales.

relationships with its customers and suppliers and reduce variability in cash flows and earnings. The combined effect of such interactions between the other variables may easily make up for the temporary increase in cost and decline in competitive advantage.

This type of research using a third party ranking suffers a few limitations, such as causality, indirectness of measurements, inherent biases of leader firms, and the selection of the control sample, as suggested by Bharadwaj (2000) and Stratopoulos and Dehning (2000). Those limitations may serve as the directions for future research.

Santhanam and Hartono (2003) suggest a different way of selecting the control sample. Instead of choosing a single benchmark firm for each e-business leader, one can consider all the firms in that industry for comparison. They argue that this method is more consistent with the procedure of selecting leaders, robust and general. Future research can consider adopting this approach of sample selection. Another logical follow-up study would be to extend the period beyond 2002 to examine the impact of e-business investment in the long term.

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## APPENDIX: E-BUSINESS LEADER FIRMS AND MATCHED SAMPLE

E-Business Leaders	SIC	Control Sample	SIC
ANHEUSER-BUSCH COS. INC.	2082	KIRIN BREWERY LTD -ADR	2082
MILLER (HERMAN) INC.	2520	HON INDUSTRIES	2522
KIMBERLY-CLARK CORP.	2621	3M CO.	2670
KNIGHT-RIDDER INC.	2711	AMERICAN GREETINGS -CL A	2771
AIR PRODUCTS & CHEMICALS INC.	2810	ROHM & HAAS CO.	2821
DU PONT (E I) DE NEMOURS	2820	BAYER A G -SPON ADR	2800
DOW CHEMICAL	2821	AVENTIS SA -ADR	2834
EASTMAN CHEMICAL CO.	2821	PRAXAIR INC.	2810
BRISTOL MYERS SQUIBB	2834	ABBOTT LABORATORIES	2834
AVON PRODUCTS	2844	LAUDER ESTEE COS INC -CL A	2844
PPG INDUSTRIES INC.	2851	COLGATE-PALMOLIVE CO.	2844
GILLETTE CO.	3420	CROWN HOLDINGS INC.	3411



CISCO SYSTEMS INC.	3576	SUN MICROSYSTEMS INC.	3571
EMERSON ELECTRIC CO.	3600	ELECTROLUX AB -ADR	3630
AMERICAN PWR CNVRSION	3620	ALTERA CORP.	3674
WHIRLPOOL CORP.	3630	KYOCERA CORP -ADR	3663
NORTEL NETWORKS CORP..	3661	ERICSSON (L M) TEL -ADR	3663
INTEL CORP.	3674	MOTOROLA INC.	3663
DAIMLERCHRYSLER AG	3711	FORD MOTOR CO.	3711
RAYTHEON CO.	3812	NORTHROP GRUMMAN CORP.	3812
CSX CORP.	4011	NORFOLK SOUTHERN CORP.	4011
UNION PACIFIC CORP.	4011	BURLINGTON NORTHERN SANTA FE	4011
UNITED PARCEL SERVICE INC.	4210	UNITED STATES POSTAL SERVICE	4210
CONSOLIDATED FREIGHTWAYS CP	4213	YELLOW CORP.	4213
ALASKA AIR GROUP INC	4512	AMERICA WEST HLDG CP -CL B	4512
AMR CORP/DE	4512	BRITISH AIRWAYS PLC -ADR	4512
DELTA AIR LINES INC.	4512	NORTHWEST AIRLINES CORP.	4512
AT&T CORP.	4813	DEUTSCHE TELEKOM AG -SP ADR	4813
COX COMMUNICATIONS -CL A	4841	BRITISH SKY BRDCSTG GP -ADR	4833
ARROW ELECTRONICS INC.	5065	GENUINE PARTS CO.	5013
AVNET INC.	5065	TECH DATA CORP.	5045
PENNEY (J C) CO.	5311	TARGET CORP.	5331
SEARS ROEBUCK & CO.	5311	KMART HOLDING CORP.	5331
OFFICE DEPOT INC.	5940	TOYS R US INC.	5945
STAPLES INC.	5940	RITE AID CORP.	5912
J P MORGAN CHASE & CO.	6020	CITICORP	6020
MELLON FINANCIAL CORP.	6020	BANCO COMERCIAL PORTGE -ADR	6020
SCHWAB (CHARLES) CORP.	6211	BEAR STEARNS COMPANIES INC	6211
HARTFORD FINL SVCS GRP INC.	6331	MILLEA HOLDINGS INC. -ADR	6331
HILTON HOTELS CORP.	7011	STARWOOD HOTELS & RESORTS WLD	7011
MARRIOTT INTL INC.	7011	INTERCONTINENTAL HOTELS-ADR	7011
INTL BUSINESS MACHINES CORP	7370	FUJITSU LTD -SPON ADR	7373
COMPUTER ASSOCIATES INTL INC.	7372	KELLY SERVICES INC -CL A	7363
MICROSOFT CORP.	7372	ADECCO S A -SPON ADR	7363
GENERAL ELECTRIC CO.	9997	SIEMENS A G -SPON ADR	9997

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