Influences on the Corporate Adoption of Web Technology

AJIT KAMLIL, ARNOLD KAMIS, MARIOS KOUFARIS, AND HENRY C. LUCAS, JR.

Virtually every brick-and-mortar firm has a Web site today, but this has not always been the case. Some companies quickly established a Web presence with thousands of pages of information available on their sites and even early e-commerce features. Others started with a simple Web site establishing a “front window” on the Web. Some companies did not appear on the Web until much later when it became essential for all businesses to do so.

This article explores the roles of senior management and firm resources in the early adoption of Web technology. We endeavor to determine what distinguished firms that embraced the Web and established an early Web presence from firms that did not consider the Web important. Although our data, collected during 1996–1997, is somewhat dated, the results of this study, particularly findings concerning management’s role in adoption, can be generalized to other IT innovations besides Web sites, including electronic commerce capabilities, enterprise software, and supply chain management systems, as well as future technologies yet to appear.

Previous research suggests that predicting a firm’s response to new technology necessitates an examination of the leadership and strategic direction of senior management. A consistent finding in early research on system implementation is that management support is related to success [9]. A firm that emphasizes technology as a part of its strategy is likely to have recognized the potential importance of the Internet and to have established a site. A firm that has not created a site for the general public is unlikely to have established an intranet or an extranet.

Also, firms with more resources are more likely to invest in a Web presence than firms with fewer resources. Knowledge is a major resource, and resource-rich firms are more likely to have personnel knowledgeable about technology and interested in innovation.
Such firms can also afford to experiment with new technology [1, 4, 12]. Resource-rich firms were found to make greater use of networks both in the U.S. and in France [11]. (Interestingly, a public network infrastructure, the Minitel system in France, made it possible for firms to use networks regardless of their resources.)

Competition, the need for communication, and the marketing promotions of the technology providers are other factors that have been shown to influence the adoption of a new technology [5]. In this article we attempt to demonstrate that companies with a greater need to communicate information to outside parties such as shareholders are likely to have a Web site.

We will also examine differences in the presence and content of Web sites based on industry. Jarvenpaa and Ives found differences in information technology strategy among industries, with information-intensive industries such as retailing, banking, and publishing displaying more awareness of technology [8].

The Study
We obtained financial data on a random sample of firms from the BusinessWeek 1000, a roster of the largest firms in the U.S. based on 1995 market values (Table 1 indicates where we obtained the rest of the study data). Using an approach found in previous research, we analyzed chairmen’s letters from annual reports to discover a firm’s strategy [3, 8, 10]. Two of the authors read the chairmen’s letters from 1994 and 1995 annual reports for the firms in the sample, notating statements related to information technology and the Internet. The sidebar “IT Mentions in Chairmen’s Letters” contains interesting examples of statements about information technology in various companies.

<table>
<thead>
<tr>
<th>Characteristic of Company</th>
<th>Definition</th>
<th>Source</th>
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<tbody>
<tr>
<td>Leadership/strategy</td>
<td>Annual report IT statements (94-95)</td>
<td>Annual reports</td>
</tr>
<tr>
<td>Firm resources</td>
<td>1995 Business Week rank in top 1000</td>
<td>Business Week</td>
</tr>
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<td></td>
<td>Market Value (millions)</td>
<td>Business Week</td>
</tr>
<tr>
<td></td>
<td>1994 Sales (millions)</td>
<td>Business Week</td>
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<td></td>
<td>1994 Profits (millions)</td>
<td>Business Week</td>
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<td></td>
<td>Return on equity</td>
<td>Business Week</td>
</tr>
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<td></td>
<td>Assets (millions)</td>
<td>Business Week</td>
</tr>
<tr>
<td></td>
<td>Share price</td>
<td>Business Week</td>
</tr>
<tr>
<td>Communications</td>
<td>Stock turnover 1994 (number of times entire stock of company changes hands)</td>
<td>Business Week</td>
</tr>
<tr>
<td>Web site</td>
<td>Presence of a Web site (1 = yes, 0 = no)</td>
<td>Web survey</td>
</tr>
<tr>
<td>Site characteristics</td>
<td>Interactive rating of Web site (8 items reflecting number of interactive features)</td>
<td>Web survey</td>
</tr>
<tr>
<td>Industry</td>
<td>Can conduct business on Web site (4 items reflecting ability to conduct any kind of transaction on site)</td>
<td>Web survey</td>
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</table>

Table 1. Data in the study.
Table 2 describes the characteristics of companies in our sample with and without Web sites. It includes several measures of firm resources, as well as a measure of stock turnover. We included the latter measure because evidence suggests that firms with actively traded stock (high turnover) have a greater need to communicate with the public than firms with less active stock.¹

Research on technology adoption has included other variables such as the influence of competitors and technology vendors. It is possible that competition encouraged some companies to develop Web sites, but our research is based on secondary data so we were unable to include such a variable.

To determine if there was a Web site and to evaluate its contents, we developed a survey instrument to be used when visiting sites.² From May through August of 1996 we searched for and evaluated the Web sites in the study. Our final sample resulted in 98 companies due to mergers and missing data. Of these firms, we found Web sites for 47 companies, leaving 51 without Web sites.

Results
We used multiple regression to test our predictions; for readers interested in the statistical results, see the sidebar “Data Analysis and Regression Results.” Our analysis shows that the most important factor in our model predicting the presence of a company on the Web in 1996 is the number of mentions of IT in the chairman’s letter from the firm’s annual report. Comments in the chairman’s letter indicate the role and importance of technology in the company and of IT’s role in strategy. Management awareness of IT and its public discussion of success stories in the annual report predict the adoption of Web technology.

We found that Web companies had three times the number of mentions of IT in their chairman’s annual letters compared with companies without a site. Web companies’ market value and sales were twice those of non-Web site firms; their profits were almost four times the profits of non-Web site companies. The Web companies

<table>
<thead>
<tr>
<th>Variable</th>
<th>Web Site Mean (n = 47)</th>
<th>No Web Site Mean (n = 51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Week rank</td>
<td>434</td>
<td>588</td>
</tr>
<tr>
<td>Market value (millions)</td>
<td>4,874</td>
<td>2,435</td>
</tr>
<tr>
<td>1994 sales (millions)</td>
<td>4,367</td>
<td>2,003</td>
</tr>
<tr>
<td>1994 profits (millions)</td>
<td>402</td>
<td>106</td>
</tr>
<tr>
<td>Return on equity</td>
<td>23</td>
<td>11</td>
</tr>
<tr>
<td>Assets (millions)</td>
<td>15,745</td>
<td>3,851</td>
</tr>
<tr>
<td>Stock turnover</td>
<td>108</td>
<td>75</td>
</tr>
<tr>
<td>Mentions of IT in chairman’s letter</td>
<td>2.57</td>
<td>0.73</td>
</tr>
</tbody>
</table>

All differences are statistically significant at the .05 level or better except for share price and stock turnover which are significant at the .10 level.

Table 2. Differences between companies with and without Web sites.

¹ The researchers involved have hypothesized that greater disclosure encourages more turnover while we use turnover as an indicator of a need to communicate [2, 7]
² Two authors conducted a pretest on 25 companies not in the sample to develop an algorithm for searching for Web sites (which search engines to use and in what order) and to determine their interrater reliability in completing the evaluation form.
had twice the return on assets and more than four times the assets of non-Web firms, as well as higher share price and greater stock turnover. We do not believe that having a Web site is responsible for these huge differences, but rather that firms with technology leadership and resources were the most likely to have a Web presence.

While having more resources seems an obvious reason for one company to have a Web site over another, our sample is from the BusinessWeek 1000: the largest firms in the U.S. based on market value. It is likely that any of these firms could have afforded to develop a Web site by 1996 using internal IT staff, or one of the many firms who offer such services. Thus, while firm resources and the need to communicate with the public do predict the presence of a Web site, we believe that senior management support is the most important factor; ultimately management allocates the firm’s resources for creating and maintaining a presence on the Web.

Evaluating Sites
In terms of specific characteristics of Web sites, we found that management leadership/strategy, the need to communicate and firm resources were weakly associated with specific characteristics of Web sites. The results suggest that factors not included in our study have a strong influence on the characteristics of Web sites. Examples of these variables might be the length of time the Web site has existed, the number of versions of the site, and the backgrounds of the site designers.

Sites that we found engaging showed a sense of company commitment to a presence on the Web. The sites reflected whether or not the developers were caught up in the excitement novelty of the technology. While our quantitative data does not support this conclusion, our impressions are that firms interacting with the public, such as financial, insurance, and service companies, had the best sites in 1996. We also would guess that the developers of the best sites were not from an IS group alone, but included employees from other areas like marketing, customer service, and investor relations.

Industry Differences
We found no significant differences in the presence and characteristics of Web sites based on industry. To test for industry differences, we tried a number of approaches. First, we used categories based on industry classifications applied by BusinessWeek. We then categorized companies from their sites as consumer or industrial firms. These categories were not mutually exclusive, so we formed combined categories.

At least for this sample, we conclude that industry does not make a difference. Web technology appeals to all types of firms, and there does not appear to be a single industry or group of industries that have adopted the Net to the exclusion of others.

Conclusion
This study has shown an association between management, firm resources, and communications and the presence of a Web site and its characteristics in 1996. Since the data in this study was collected at one point in time, it cannot demonstrate causality. Our findings suggest that management leadership and strategy, firm resources, and the need to communicate lead to a Web site and partially determine its contents. Because we measured management leadership and strategy in 1994–1995, firm resources in 1994, and evaluated Web sites in 1996, this direction of causality seems most likely. It would be difficult to argue that the presence of a Web site in 1996 could be responsible for a firm’s market value in 1994.
If one is willing to attribute any causality to the results, what are the implications? We believe the results show the importance of senior management support and the inclusion of technology in corporate strategy in the adoption of a major technological innovation. Senior managers can make a change in the direction and emphasis of a firm. Consider the conversion of Microsoft to a company that embraces the Internet for all of its products. This change, while championed by middle managers, caught the chairman’s attention. He had the ability to change the direction of the firm and establish a new division with over 2,000 employees to create and adapt products for the Internet.

The results also show the importance of firm resources in network adoption, similar to the findings by Streeter et al. [11]. But as noted earlier, all of these firms could easily afford to make or buy a high-quality Web site. We feel that resources alone are not enough to explain the adoption of technology: one also needs management leadership to allocate resources to technology.

What can we say about the firms that fail to adopt new technology? Firms without sites may pay a high price if they fall behind on the learning curve. The first Web sites were static and for the most part only provided information; the most advanced technology enabled users to complete a form. Today’s more sophisticated Web sites feature Java applets, ActiveX programs, and Shockwave animation. Early adopters of the Web will be better able to keep up with these new developments, and are well positioned to develop intranets and extranets. Web experience also prepares firms for electronic commerce, an increasingly important market channel. The importance of establishing a presence on the Internet is becoming evident; six months after our initial survey, 22 of the 51 firms without Web sites had developed them.

Based on this research, our recommendation to senior management is to stay abreast of technology, integrate IT with corporate strategy, and apply resources to innovation. Senior management sets the direction for technology, allocates resources and provides leadership. The adoption of innovations like the Web cannot be left to the IT manager and staff; firms that delay or never innovate run the risk of being left behind in a period of rapidly advancing technology.

References


IT Mentions In Chairmen’s Letters

“Communication with agencies regarding policy information has improved substantially through greater use of online agency management systems, which download policy information directly to agency offices...Our challenge is to balance investments in technology with expense management, an area of focus for 1995...We expect to begin to realize cost savings from our investments in technology and process reengineering programs, and to see the overall expense ratio beginning to improve in 1995.” Allmerica Property & Casualty Cos, Inc. 1994.

“...we will continue to seek further operating economics, and to advance technology solutions wherever feasible. For example, we will invest in Corporate Risk Management Services business as it continues to pursue growth opportunities in nontraditional markets, but we will also leverage this unit’s expertise to manage health care costs better....” Allmerica 1995.

“We are highly competent at large-scale, efficient high-volume processing to support customer transactions. We clear approximately 20 million checks nightly—nearly 10% of the national total cost-effectively. Cumulatively, we are the largest bank processor of ATM, credit, and debit card and automated clearing house transactions in the western U.S. Altogether, approximately 40% of the GDP in the West is processed through Bank America...In retail banking we continued...opening experimental self-service branches, expanding our in-store branch network, and creating a Bank America presence on the Internet.” BankAmerica 1994.

“We have established an interactive presence on the Internet's World Wide Web and opened an electronic branch on America Online.” BankAmerica 1995.

“During 1995 we affirmed in many ways our belief in technology as an important competitive tool. We invested in improved technology for consumer and business banking services and also in our third party processing businesses. We initiated a project, Workplace 21, to develop the internal information supports for further progress in empowering employees to make decisions on behalf of customers. Late in the year we
launched a broad strategic review of future technology needs.” Corestates Financial 1995.

"A second and related byproduct of Fleet Focus was the realization that we had to make a much heavier capital commitment to technology. Perhaps the single greatest challenge our industry faces today is to harness technological advances to help customers access, move, and manage their money.” Fleet Financial 1994.

“Our investment in technology will also continue in 1995. The development of a major system to reorder merchandise for the stores and distribution centers, and a manager’s workstation to facilitate more efficiencies at the store level, are high priority projects.” Revco DS 1994.

“Revco invested approximately $140 million this past year to upgrade technology and improve the condition of our store base and distributor systems….Also Revco must invest in technology to improve productivity, and leverage costs against pressured prescription margins, to respond effectively in a consolidating industry.” Revco DS 1995.

“We are building a single, integrated computer network that accepts orders, assigns inventory, forecasts future requirements, schedules plant production, replenishes stocks and keeps track of costs. This system allows a person sitting in our French office to take a phone call from a U.K. customer and—while the customer is still on the phone—arrange for products to be shipped from a plant or warehouse anywhere in Europe…We began to see cost savings from this system in 1994 and expect even greater savings over the next few years—perhaps as much as $75 million per year by the end of the decade.” Rohm and Haas 1994.

All companies cited except Allmerica had a Web site as of August 1996.

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**Data Analysis and Regression Results**

To assess the evidence for our four predictions, we used the data described in Table 1 in a series of regression equations. Regression relates a series of independent variables to a single, dependent variable. In the case of a single independent variable and a linear
relationship, the regression procedure estimates the intercept and the slope of the line that fits the data best. The most common regression is ordinary least squares or OLS. The OLS estimate defines the best fit as minimizing the squared distances of each data point from the estimated regression line. The goodness of fit determines how well the estimated line predicts the actual data points observed; this R² value can lie between 0 (no predictive power) to 1 (perfect prediction).

For column 1 the data is regression coefficients; for columns 2–5 it is beta weights. Columns 1 and 2 predict Web sites in the full sample; columns 3–5 predict characteristics of the sites we found.

We used two equations to predict a Web presence because the dependent variable, Web site, is either a 0 or a 1. A logistic model is tested in Column 1, which explicitly takes into account the binary dependent variable in predicting the odds of having a Web site. Column 2 is an ordinary least squares model predicting the probability of having a Web site. The OLS model in Equation 2 is easier to explain and produces the familiar goodness of fit measure, R². Columns 2–5 present beta weights that indicate the change in the dependent variable in standard deviation units that results from a change of one standard deviation unit in an independent variable.

Column 2, for example, shows that IT mentions in the annual report has the strongest (highest beta weight) relationship with the presence of a Web site, and it is highly statistically significant. It is followed by return on equity, annual share turnover, and the log of 1994 sales.

3 Positive coefficients in the logistic equation increase the predicted probability of a firm having a Web site, but do so in a nonlinear fashion. If g(x) = the right hand side of Equation 1, we would predict the probability that a company has a Web site using \( \frac{e^{(g(x))}}{1 + e^{(g(x))}} \). The simpler coefficients of the OLS version in Equation 2 are easier to interpret. Greene suggests that the two models may in some cases produce similar results [6].