

Exploring the factors associated with Web site success in the context of electronic commerce

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Received 20 January 1999; accepted 24 November 1999

Abstract

Web sites are being widely deployed commercially. As the widespread use and dependency on Web technology increases, so does the need to assess factors associated with Web site success. The objective is to explore these factors in the context of electronic commerce (EC). The research framework was derived from information systems and marketing literature. Webmasters from Fortune 1000 companies were used as the target group for a survey. Four factors that are critical to Web site success in EC were identified: (1) information and service quality, (2) system use, (3) playfulness, and (4) system design quality. An analysis of the data provides valuable managerial implications for Web site success in the context of electronic commerce. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Web site success; Electronic commerce; Fortune 1000; Cybermarketing

1. Introduction

Web sites are being widely deployed throughout industry, education, government, and other institutions. In practice, the importance of the use of Web technology for electronic commerce (EC) activities has been discussed widely (e.g., [32,34,50,58,59,61]). EC is a way of conducting business by companies and their customers performing electronic transactions through computer networks [19]. EC can help business organizations cut costs, interact directly with customers, run more smoothly and in a more timely manner, and even better, it can help an organization outperform its competition.

As the dependency on Web technology increases, so does the need to assess factors associated with Web site success. Although there has been significant research on supporting EC, existing empirical research focusing on success factors of Web sites is mainly anecdotal and exploratory in nature. Few studies involved more than one or two measurement variables involved in a Web site design. Thus, while there should be a considerable number and variety of factors associated with Web sites success, little knowledge exists above the combination of these factors. In addition, the preponderance of studies focuses on building security for on-line transactions on the Web [31,43]. Customers would not pay for products or services over the Web if financial information could not be transmitted securely: secure transactions are critical to the success. However, security is only a necessary but not a sufficient condition of designing a successful Web site: a secure Web market does not guarantee customers.

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2. Specification of Web site success

The general definition of IS success is: the extent to which a system achieves the goals for which it was designed [23]. A Web site is a new type of information technology. In the context of EC, the functions and features provided by companies' Web sites can be classified into three phases of marketing: pre, on-line, and after sales [39]. Any EC activity fits within these three classifications. The *pre-sales* phase includes a company's efforts to attract customers by advertising, public relations, new product or service announcements, and other related activities. Customers' electronic purchasing activities occur in the *on-line* sales where orders and charges are placed electronically through Web facilities. Kotler [33] stressed that trustworthy, dependable, and reliable characteristics are important to trigger business transactions. The *after-sales* phase includes customer service, problem resolution etc. This phase should generate or obtain customer satisfaction by meeting demand and pleasing customers. Thus, a successful Web site, in the context of EC, is one that attracts customers, makes them feel the site is trustworthy, dependable, and reliable and generates customer satisfaction.

3. Theoretical framework

As EC on the Web deals with both IS and marketing activities, literature from both areas is appropriate in the research context. In the marketing arena, consumer information search strategies and measuring service quality were investigated. In the IS arena, a search was made of IS management, measuring IS success, and end-user computing.

3.1. Information quality

Prior research employed various measures of IS success, including user satisfaction [2,28,35,52], business profitability [13,44], improved decision quality and performance [42,49,54,62], perceived benefits of information systems [20,30,51], and the level of system usage [21,22]. All of them stressed the importance of information quality. This leads to the following hypothesis:

H1. Information quality is directly related to Web site success.

3.2. Learning capability

EC is an interactive function between customers and business enterprises [9]. Many studies have emphasized the importance of the two-way on-line communication between customers and firms (e.g., [5,9,16,41]). Such knowledge will not only facilitate building relational markets but also increase customers' abilities to learn how to browse and to find relevant information on the Web. Business on-line can profit from the interactive culture on the Web [6].

For many potential customers, using Web technology for EC activities is a new experience. Also, providing interactive learning tools is necessary since consumers need to develop and apply their abilities through exploratory behavior [60]. Thus, we propose:

H2. Learning capability is directly related to Web site success.

3.3. Playfulness

The importance of playfulness has been emphasized by Web site designers. A study by Rice [53] suggests that the likelihood of a repeat visit to a Web site is enhanced when the visitors find the visit enjoyable.

In the context of marketing, hedonic value reflects shopping's potential entertainment and emotional worth [15]. A satisfied customer not only comes from an extrinsic reward of purchasing products or services but also from personal and emotional reward from purchasing-derived pleasure [29]. This suggests that shopping on the Web produces both hedonic and utilitarian outcomes.

There is a need for Web designers to cultivate hedonic pleasure in site design by motivating customers to participate, promoting customer excitement and concentration, and including charming features to attract customers and to help them enjoy the visit. This will lead to increased customer activities [55]. Therefore, another hypothesis is:

H3. Playfulness is directly related to Web site success.

3.4. System quality

According to a survey conducted by the European Electronic Messaging Association, more than 79% of respondents said that design quality, especially security, is the top concern of EC customers [56]. However, security is only one aspect of designing the system quality. Anderson and Bezuidenhout [3] stressed that reliability is also needed, especially in consumer electronic markets. A reliable system should have quick error recovery and ensure correct operation [10]. Thus, we propose:

H4. System quality is directly related to Web site success.

3.5. System use

The way in which customers use a Web site for EC is also important. Success of the IS is often employed as a measurement of success of the entire system [27]. Also, system use can be an important determinant of user satisfaction [12].

System use can be measured in several ways. Friedman [24] concluded that obtaining consumers' confidence in EC transactions is very important. Without it, customers will not use on-line sales and payment functions. Customers should be able to trust the system and use its on-line purchase capabilities [1]. They should feel that the system is both under their control and easy to use. In addition, Web designers should allow customers to track their on-line order status [40]. Thus, another hypothesis is:

H5. System use is directly related to Web site success.

3.6. Service quality

Prior studies have stressed the importance of providing high quality of service [57,63]. Business organizations and Web designers should actively seek ways to improve service quality at Web sites. To make it more challenging, management and Web designers should carefully consider how to arrange and present customer service opportunities. This care is necessary because of the lack of face-to-face contact on a Web site. Thus, we propose the final hypothesis:

H6. Service quality is directly related to Web site success.

4. Research methodology

Fig. 1 illustrates the research framework. The general methodology involved an electronic questionnaire survey of webmasters from Fortune 1000 companies. Webmasters are typically responsible for managing Web sites or home pages and serve as the implementers of marketing strategy. As a result, they should have rich information about their Web sites since these Web sites are used as bridges to connect customers and internal business organizations [7]. Despite early success of small business on the Web, large business organizations have historically provided leadership in the use of information technology [38]. Therefore, the use of the Fortune 1000 companies as the target group seemed most appropriate.

4.1. Sampling procedure

The mailing list of the webmasters was determined by visiting each Fortune 1000 home page. Their URL addresses were searched through the Netscape Search Engine and Hoover's on-line database. At the time of visit, the webmaster's e-mail address was recorded.

FORTUNE provides summary information on the Web regarding the performances of the Fortune companies. A searchable database of the company, Hoover's Online (<http://www.hoovers.com>), was used to obtain URLs. Netscape's Net Search was used to obtain URL addresses that were unavailable from Hoovers.

The proposed questionnaire was evaluated by a person-to-person visit to six webmasters who are considered to be content experts. The survey questionnaire was also pre-tested for content and readability by using webmasters of the top 100 Web sites that were earlier identified by *PC Magazine*. The purpose of this was to further examine the content validity of the questionnaire and to estimate the response rate for a large sample survey. A low response rate of 5% from this pre-test suggested the need for a more appealing cover letter and possibly the use of an electronic questionnaire sent individually to each webmaster. Both of these changes were made for

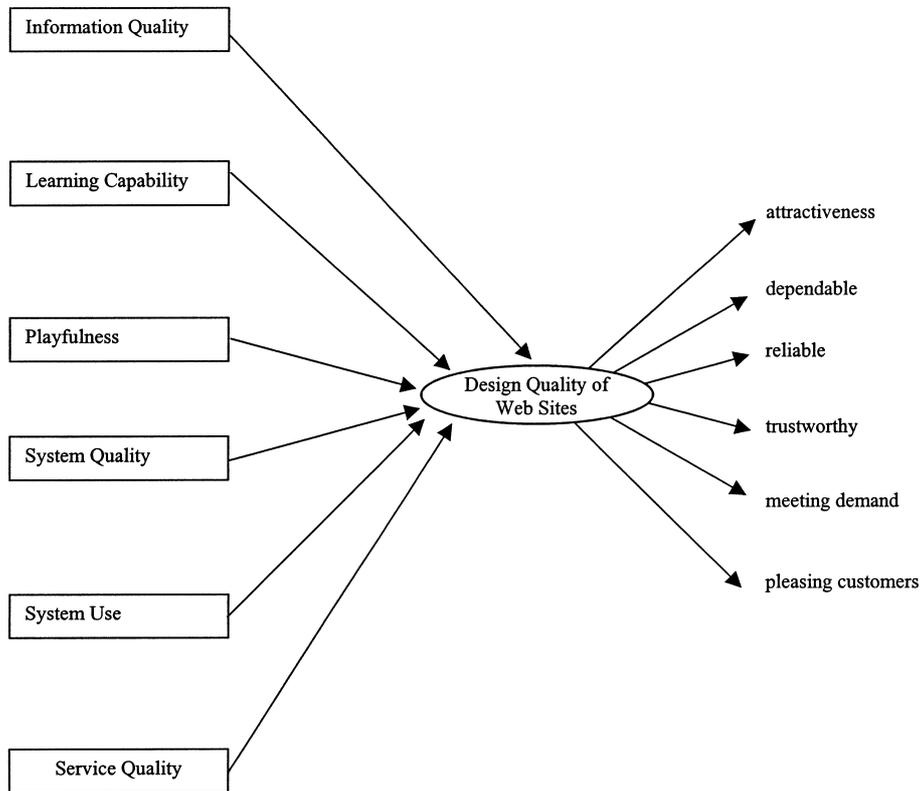


Fig. 1. Research framework.

the final questionnaire, which was delivered to available Fortune 1000 webmasters in two formats: directly sent through e-mail and via a home page. Webmasters were asked to select one format.

4.2. Measurement of variables

The research model was derived from the study of IS and marketing literature. Potential measurement variables were derived from key word searches of electronic market, EC, electronic transaction, and electronic marketplace in ABI/INFORM, an on-line database marketed by University Microfilms (UMI). The use of on-line databases, and ABI/INFORM in particular, as a research tool has been well established [47]. The key word searches yielded about 1000 relevant 'hits.' These were scanned by reading titles and abstracts. All variables in the survey were measured on a seven-point Likert scale from (1) comple-

tely unimportant to (7) completely important. Table 1 shows the research constructs, their measurement variables, and the internal reliability assessment.

4.2.1. Information quality

From our literature review, we selected the following variables for measuring information quality: accuracy, timeliness, relevance [4]; flexible information presentation; customized information presentation; price information; product/service comparability, product/service differentiation, complete product/service description [14]; perceived information quality on product/service; satisfying ethical standard [36]; and support business objectives [45]. Our combined literature from the relevant, but separate, disciplines indicates these variables are important aspects of IS quality. On account of the diversity in variable identification, there is no justification for assigning different weights to the variables. Thus, the average

Table 1
Research factors, measurements, and reliability assessment

| Hypothesis number | Research construct | Measure component | α |
|-------------------|---------------------|--|----------|
| H1 | information quality | relevant; accurate; timely information; flexible and customized information presentation; products/services differentiation; complete description of products/services; price information; satisfying ethical standards; perceived products/services quality; information to support business objectives | 0.78 |
| H2 | learning capability | interactive function between customers and business organization; well defined link; help function; customized search engine | 0.55 |
| H3 | playfulness | enjoyment; excitement; feeling of participation; charming; escapism | 0.83 |
| H4 | system quality | security; rapid accessing; quick error recovery; precise operation and computation; balanced payment method between security k , ease of use; coordination | 0.75 |
| H5 | system use | confidence; control; ease of use; track on-line order status; privacy | 0.93 |
| H6 | service quality | quick responsiveness, assurance; empathy; following-up service | 0.86 |

score of these variables is our measure of information quality.

4.2.2. Learning capability

Five variables were used to measure learning capability: well organized hyperlink, help function; customized search engine [11]; interactive function between customers and businesses, and interactive function among customers. Again, the absence of contrary justification allows us to use the average score of these variables our measure.

4.2.3. Playfulness

This is a five-item instrument adapted from the measurement used by Badin, Darden, and Griffin [8]. The variables are: enjoyment, excitement, feeling of participation, escapism, and charming. The average score of these variables is our measure.

4.2.4. System quality

This was measured by six variables: rapid access (processing speed), quick error recovery, correct operation and computation; security [17]; balanced payment method between security and ease of use [48]; and coordination to support all functional areas. The average score of these variables is our measure.

4.2.5. System use

As discussed in Section 3.5, the measurement variables of system use are: customers control of a transaction process, ease of use, confidence, tracking order status, and privacy. The average score of these variables is our measure.

4.2.6. Service quality

Quick responsiveness, assurance, reliability, empathy, and follow-up service are used to measure service quality. These measurements are well established in marketing literature. The average score of these variables is our measure.

4.3. Reliability of the measures

In order to ensure that the variables comprising each proposed research construct were internally consistent, reliability assessment was carried out using Cronbach's alpha. A low value of Cronbach's alpha (i.e. close to 0) implies that the variables are not internally related in the manner expected [18]. Since the mean values of 'a feature to compare product/service with competitors' (mean=3.91) and 'interactive communications among customers' (mean=3.96) were lower than 4.0, indicating a relative unimportance on the scale, these variables were dropped from further analysis. The internal consistency reliability coefficients for the research constructs in this study are all well above the 0.50 level. However, a widely used rule of thumb of 0.60 has been suggested by Nunnally [46], and therefore, the reliability coefficient for learning capability (0.55) might be seen as inadequate.

4.4. Validity of the measure

To ensure content validity, a thorough examination was made of the relevant literature. To further reduce the possibility of non-random errors, six webmasters

and PC Magazine's top 100 Web sites webmasters were asked to review the questionnaire for validity (measuring what is intended), completeness (including all relevant variable items), and readability (making it unlikely that webmasters will misinterpret a particular question). Three questions were deleted and five were reworded to improve the readability.

5. Data analysis and results

Only 762 of the Fortune 1000 companies were found to have public home pages through Hoovers and Infoseek search engines at the time of this study. Of the 762 companies, a total of 689 webmaster's e-mail addresses were collected by browsing the companies' home pages and/or completing their electronic feedback form to request the e-mail address. It is interesting to note that about 15 home pages of Fortune 1000 companies were created and maintained by other companies, such as ImageSoft, FCGNet, Computer Graphics, Webvision, Internet Publishing etc. Since these design companies are responsible for managing their clients' home pages, their webmasters were also included in the study.

The survey was first electronically mailed to 689 webmasters of Fortune 1000 companies. The number of undelivered and returned questionnaires was 28 so that 661 total questionnaires were mailed. This mailing received 98 responses. A follow up notification and a second copy of the questionnaire resulted in 24 additional responses, giving a total of 122 responses. Of these, three were rejected because many items were left blank, yielding a final usable response rate of 18%. Non-response bias was examined by comparing the industry type of the respondents to the entire sample of Fortune 1000 companies. The Chi-square goodness-of-fit (Chi-square=12.17, $p<0.06$) test showed that industry type of respondents were not significantly different from the Fortune 1000 companies as a whole.

Table 2 presents the characteristics of the respondents. The responding webmasters represent a broad coverage of industry classes, which indicates that the survey results can be used to explain webmasters' perceptions for design quality of electronic marketplaces on the Web across different types of industries.

Table 2
Characteristics of respondents^a

| | Number | Percentage (%) |
|--|--------|----------------|
| 1. Industry | | |
| Construction | 2 | 1.68 |
| Finance, insurance, and real estate | 16 | 13.45 |
| Manufacturing | 38 | 31.93 |
| Retail trade | 8 | 6.72 |
| Service | 18 | 15.13 |
| Transportation, communications, electric, gas and sanitary services | 28 | 23.53 |
| Wholesale trade | 2 | 1.68 |
| Others | 2 | 1.68 |
| Missing | 5 | 4.20 |
| Total | 119 | 100 |
| 2. Gender | | |
| Male | 79 | 66.39 |
| Female | 36 | 30.25 |
| Missing | 4 | 3.36 |
| Total | 119 | 100 |
| 3. Age group | | |
| 20–25 | 12 | 10.08 |
| 26–30 | 22 | 18.49 |
| 31–35 | 28 | 23.52 |
| 36–40 | 11 | 9.24 |
| 40–45 | 15 | 12.61 |
| Greater than 45 | 25 | 21.01 |
| Missing | 6 | 5.04 |
| Total | 119 | 100 |
| 4. Job length as webmaster | | |
| Less than 6 months | 12 | 10.08 |
| 6–12 months | 37 | 31.09 |
| 13–24 months | 46 | 38.66 |
| Greater than 24 months | 17 | 14.29 |
| Missing | 7 | 5.88 |
| Total | 119 | 100 |

^a Note: The classification of the industry type is based on Fortune Magazine.

5.1. Hypothesis testing

One purpose of the webmaster questionnaire was to provide data in order to test the research hypotheses. Mean values and a matrix of intercorrelations among the research constructs were calculated. The average response for the six items is considered by us to be the measure of the overall web design importance value. If the overall importance mean value rating correlated positively and significantly with the six research con-

structs, the six hypotheses could be supported. The means, standard deviations, and matrix of inter-correlations among the six research constructs are presented in Table 3. The overall web design importance rating correlated positively and significantly with all six independent constructs. The probabilities (p values), which are shown in parentheses, are less than 0.01. Therefore, research hypotheses H1–H6 can be supported.

5.2. Factor analysis

In order to further determine factors associated with Web site success, an exploratory factor analysis was performed after hypotheses testing. Kaiser's measure of sampling adequacy (MSA) was calculated. The overall MSA was 0.86. In addition, all individual variables' MSAs (except for the two that were dropped) were greater than 0.70. This clearly suggests that factor analysis can be used to extract research factors [25].

Several rules are typically applied when addressing how many factors to extract. To obtain a meaningful or interpretable grouping of the variables, we employed the rules of eigenvalue greater than 1, percentage of variance extracted accounts for at least 5% of the common variance, and the Screen test. Four factors were extracted. To obtain a simpler and theoretically meaningful factor pattern, an oblique rotation with PROMAX was applied. Here, a desired level of significant factor loadings should be specified to explain the factor rotation results. Various researchers have given different cut-off values for retention based on the value of factor loadings. Some used the cut-off value of 0.35 [37], while others used the cut-off value of 0.50. In order to obtain meaningful factor rotation results, both cut-off values of 0.35 and 0.50 were selected to evaluate the factor patterns. The cut-off value of 0.35 obtains three additional variables for the fourth factor. Based on Hatcher's suggestion [26] that at least three variables with significant loadings should be included on each retained factor, a cut-off value of 0.35 was applied for this study. Table 4 presents the factor structure with the names of the factors being subjectively inferred from the nature of the grouped items.

After the factor analysis, a reliability test was performed for the extracted factors. None of the four

factors' alpha is lower than 0.6. Consequently, these factors provide a reliable and consistent measure of intended dimensions and no further elimination of variables appears necessary.

The factor analysis shows that only four factors are really justified; they are: (1) information and service quality, (2) system use, (3) playfulness, and (4) system design quality. We note that the reliability assessment of learning capability ($\alpha=0.55$) is below the normal acceptable level ($\alpha=0.60$). Therefore, it is not surprising that a learning capability factor did not emerge from the factor analysis. Also, because a service encounter on a Web site has no face-to-face contact, it may be so different from traditional customer service activities that it is just a part of the overall information quality.

6. Conclusions and managerial implications

Apparently, Web site success in the context of EC is related to four major factors: quality of information and service, system use, playfulness, and system design quality. Organizations who launch Web sites should be more aware of these factors. Based on the results, several recommendations can be advanced.

First, business organizations and Web developers should actively seek ways to improve information and service quality provided through Web sites. Business organizations and Web designers should establish a service-oriented concept for both pre-sale and after-sale stages to provide high quality service and high quality information. For example, a Web site may provide a recommendation for a particular plug-in to allow a better presentation of its products/services, and the site might also help customers download/upgrade their plug-in. Here, both service and information quality may be enhanced. A service-oriented concept aims at serving customers better through all phases of marketing activities.

Second, business organizations and Web site designers should focus on the way in which customers use a Web site. The results indicate the importance, in general, of successful Web site design to system use. Customers rather than business organizations should control the on-line transaction process.

Third, there is a need for business organizations and Web developers to cultivate hedonic pleasures in the

Table 3
Matrix of intercorrelations among study constructs ($N=119$)^a

| Construct | Mean | S.D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------------------------|------|------|---------------|---------------|---------------|---------------|---------------|---------------|------------|
| 1. Well designed importance | 5.90 | 0.74 | 1.00 (0.0) | | | | | | |
| 2. Information quality | 5.64 | 0.68 | 0.27 (0.0028) | 1.00 (0.0) | | | | | |
| 3. Learning capability | 5.33 | 0.83 | 0.26 (0.0041) | 0.72 (0.0001) | 1.00 (0.0) | | | | |
| 4. Playfulness | 5.10 | 1.04 | 0.35 (0.0001) | 0.37 (0.0001) | 0.36 (0.0001) | 1.00 (0.0) | | | |
| 5. System quality | 5.49 | 0.99 | 0.31 (0.0006) | 0.64 (0.0001) | 0.62 (0.0001) | 0.30 (0.001) | 1.00 (0.0) | | |
| 6. System use | 5.47 | 1.39 | 0.30 (0.0008) | 0.50 (0.0001) | 0.53 (0.0001) | 0.21 (0.0189) | 0.69 (0.0001) | 1.00 (0.0) | |
| 7. Service quality | 6.16 | 0.92 | 0.42 (0.0001) | 0.70 (0.0001) | 0.59 (0.0001) | 0.39 (0.0001) | 0.59 (0.0001) | 0.53 (0.0001) | 1.00 (0.0) |

^a Note: (1) p values are in parentheses; (2) the measurement scale of mean values is from 1 (completely unimportant) to 7 (completely important).

Table 4
Variable items, key dimensions, α values, and loadings

| Variable description | Loadings |
|--|----------|
| <i>Factor 1 (F1): quality of information and service; $\alpha=0.88$</i> | |
| Customized information presentation | 0.40 |
| Relevant information to the customer | 0.77 |
| Accurate information | 0.71 |
| Complete products/services description | 0.56 |
| Perceived quality of products/services | 0.45 |
| Ethics standards | 0.60 |
| Information to support business objectives | 0.54 |
| Interactive feedback between customer and business | 0.64 |
| Quick responsiveness to customers | 0.63 |
| Assurance to solve customers' problems | 0.73 |
| Empathy to customers' problems | 0.69 |
| Follow-up services to customers | 0.67 |
| <i>Factor 2 (F2): system use; $\alpha=0.92$</i> | |
| Balanced security and ease of use payment | 0.47 |
| Insure correct transactions | 0.82 |
| Allow customers to control entire transaction | 0.87 |
| Gain Customer confidence during transaction | 0.93 |
| Ease of use for the transaction | 0.93 |
| Track order status | 0.73 |
| Keep confidential for customer information | 0.58 |
| <i>Factor 3 (F3): playfulness; $\alpha=0.83$</i> | |
| Customers to enjoy visiting the Web sites | 0.83 |
| Motivate customers to feel participation | 0.73 |
| Promote customer excitement | 0.79 |
| Charming feature to attract customers | 0.68 |
| Promote customer concentration | 0.49 |
| <i>Factor 4 (F4): system design quality; $\alpha=0.63$</i> | |
| Well organized hyperlinks | 0.62 |
| Customized search functions | 0.39 |
| High speed of accessing the Web | 0.58 |
| Ease of correcting server's error | 0.49 |

Web site by motivating customers to participate, promoting customer excitement and concentration, and including charming features to attract customers and to help them enjoy the visit. Creativity must be incorporated into the design process in order to obtain customers' psychological satisfaction when engaging in marketing on the Web.

Fourth, the results corroborated the hypothesized direct relationship of system design quality with Web site success. Surprisingly, security is absent in the system design quality factor. But without security, no customers would shop around. However, security is only a necessary condition; alone it can not attract customers and promote electronic marketing activities.

7. Limitations

The primary limitation of this research is that data about Web site success was gathered from webmasters. These perceptions tell us what these important people in the web design process believe, but they are not necessarily grounded in fact. In addition, the design and maintenance of an electronic marketplace on the Web is still in relative infancy, so there is limited knowledge for both consumers and businesses as to how to pursue electronic marketing activities on the Web. Although these results provide some important guidelines for the design of a Web site, continual monitoring of the development and functionality of Web sites will be needed. The data presented is cross-sectional, and longitudinal data will likely be needed in the future because of the dynamics of Web-enabled commerce.

Another limitation is that the results cannot be generalized to all businesses. It is true that large organizations generally provide leadership in using information technology, but differences exist between small and large businesses, especially in using the Web to compete. Therefore, careful use of the results should be made, especially as to their applicability to small businesses.

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