

UNDERSTANDING ADOPTION OF INTERNET TECHNOLOGIES AMONG SMEs

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ABSTRACT

The Internet has been viewed as a powerful tool enabling small firms to “level the playing field” when competing with larger firms. Yet, the benefits of e-business are accruing to larger, rather than smaller, firms. While numerous studies have been conducted in other countries to examine the use of the Internet by small and medium-sized enterprises (SMEs), similar studies focused on U.S. small firms have not yet emerged. Using the Commission of the European Communities’ stringent definition of SMEs, this paper identifies significantly different patterns in e-business usage among 395 micro, small, and medium-sized firms. While using the Internet to find information and to enhance the company/image brand is important for all firms, the smallest of firms attach greater importance to using the Internet for research purposes and lesser for communication reasons (i.e., e-mail). This pattern is reversed for larger (i.e., small and medium sized) firms.

INTRODUCTION

There have been few times in the history of commerce that truly major changes in the way business can be conducted have been available to small and medium-sized enterprises (SMEs). Some argue that the array of Internet technologies available today provides such an opportunity and may be revolutionizing traditional small business practices (Geiger and Martin, 1999; Lee, 2001; Daniel et al, 2002; Siu, 2002). A plethora of research exists on competitive advantages that result from incorporating the use of digital technologies into business strategies (e.g., Rayport and Sviokla, 1995; Olivia, 1997; Griffith and Krampf, 1998;

Walsh and Godfrey, 2000; Piccoli et al., 2001; Downie, 2003; Kula and Tatoglu, 2003).

Yet, recent statistics indicate that about one-third of small firms have yet to embrace the use of Internet technologies (Pratt, 2002; Auger et al., 2003). Why is this? The Internet was initially viewed as an extraordinarily powerful tool to enable small businesses to “level the playing field” when competing with larger firms by expanding access to new geographic markets (Hamill and Gregory, 1997), building name recognition, increasing cost effectiveness within the supply chain (Rayport and Sviokla, 1995), and most cost-effectively tracking customer tastes and

preferences (Haynes et al., 1998). Despite this, several researchers have reported that the benefits gained are being realized by larger, rather than smaller, firms (Auger and Gallagher, 1997; Poon and Swatman, 1997; Griffith and Krampf, 1998; Haynes et al., 1998; Hart et al., 2000; Jeffcoate et al., 2002), leading to a series of studies concentrated on identifying the drivers and barriers to adoption of e-business among SMEs.

Based on a review of this literature, Scupola reported that the most important factors affecting the adoption of e-business by SMEs are the perceived benefits and barriers to its operationalization within the firm (2003). Benefits, both direct and indirect, are numerous, including increased revenues, reduced costs of information, savings in advertising costs, increased customer service, easier and faster access to information, and improved company image, to name a few. Barriers, as identified by Scupola (and adapted from Walczuch et al., 2000), include awareness of SMEs/access to infrastructure, critical mass among business partners, confidence in legal and regulatory framework/security, and adaptation of business processes (2003), as well as financial resources, lack of in-house IT experience, and a short-range perspective (Thong, 1999). The roles played by senior managers in adopting new technologies may also explain the difference (More, 1992; Poon and Swatman, 1997; Gagnon et al., 2000; Raymond and Blili, 2000-2001; Pollard, 2003). Others have suggested that differences could be due to organizational learning styles (Chaston and Mangles, 2001) or concerns that the Internet or Web site would not lead to efficiency or lower costs (Walczuch et al., 2000). Additional considerations may include risk avoidance or staying with the known course. Given this muddle, it is appropriate to pause and ask the basic question, how do small firms pursue adoption decisions, implementation, and use of Internet technologies?

Within the United States, while the Small Business Administration (SBA) has generally defined small businesses as less than 500 employees [1], researchers who have studied small businesses' use of the Internet have employed varying definitions. As one recent example, Karagozoglu and Lindell (2004) defined small businesses as having 0-99 employees and medium-sized businesses as having 100-999 employees. Bajwa and Lewis (2003) defined small and medium-sized firms as less than 100 employees and 100-499, respectively. Critical to understanding these issues is the definition of SME and the subcategories comprising it. In this study, SME and its subcategories have been defined according to standards of the Commission of the European Communities. This is because its size standards are more discriminating than those that have been traditionally used by the U.S. Small Business Administration. According to the European definition, a medium-sized firm has a maximum of 250 employees; a small firm has a maximum of 50 employees; and a micro enterprise has a maximum of 10 employees. This definition (maximum of 250 employees) is also consistent with a recent study (i.e., Pratt, 2002) that was, interestingly, published by the Office of Advocacy of the U.S. Small Business Administration. It differs, however, in that Pratt's study (2002) did not differentiate e-business usage according to size gradations.

Moreover, numerous studies have been conducted among SMEs in Europe (e.g., Daniel et al., 2002; Feindt, 2002; Chaston and Mangles, 2003; Drew, 2003;), Asia (e.g., Riquelme, 2002; Siu, 2002; Lertwongsatien and Wongpinunwatana, 2003), and Australia (e.g., Poon and Swatman, 1997; Poon, 2000; Pollard, 2003) to explore patterns of e-business adoption and the factors that propel its successful implementation. Yet similar studies focused on U.S. firms, using discriminating size criteria, have not yet emerged in either the academic press or trade literature. Even among "small businesses," the larger the firm, the greater its need for technology (due to the larger scale of operations) as well as its ability to hire

people with specialized skills (Thong, 1999). Consequently, many of the factors identified in prior studies of U.S. firms may not be relevant to *truly* small businesses since they fail to recognize the inherent size diversity in the small business sector. Given that nearly 90 percent of U.S. small businesses have fewer than 20 employees (Zimmerer and Scarborough, 2003), this is worrisome.

This paper summarizes theoretical models and presents findings from 395 U.S. SMEs regarding adoption and use of e-business tools. This study suggests that while certain e-business applications are important to each size category (i.e., micro, small and medium-sized), there are distinct differences in patterns of usage according to the size of the organization.

THE ADOPTION PROCESS

The research done in the area of modeling adoption processes for use of Internet technologies can be conveniently grouped into three research streams. Only articles that have appeared in scholarly journals (both academic and practitioner) were considered in this review. Apart from some studies that examined the relationship between firm size and the adoption of IT innovations, very few articles dealt strictly with adoption and usage of e-business technologies in U.S. SMEs.

Research stream #1 deals with developing conceptual models focused on the identification and description of explanatory variables that stimulate or stymie Internet adoption among small firms. Scupola (2003) provides a summary of prior studies on Internet barriers (1996-1998) and e-business drivers (1996-2000), categorizing e-business drivers according to direct versus indirect benefits and short-term versus long-term perceived benefits. More recently, determinants or predictors of e-business technology usage have been identified and grouped according to four sets of variables: (1) the environmental context and industry-related factors (Mehrtens et al., 2001; Raymond, 2001; Utomo and Dodgson, 2001; Sadowski et al., 2002; Drew, 2003); (2) organizational factors, including business

practices of the firm (Mehrtens et al., 2001; Raymond, 2001; Sadowski et al., 2002; Downie, 2003); (3) the characteristics of the organization's leaders, including educational level and receptivity to change (Mehrtens et al., 2001; Raymond, 2001; Venkatesh and Brown, 2001; Lanz, 2002); and (4) characteristics of the technological innovation itself (Raymond, 2001). Research from the IS/IT literature indicates that decisions to adopt new technologies are influenced by two variables: perceived usefulness and perceived ease of use (Davis 1989; Davis et al. 1992) [2]. Other factors that have been identified to influence e-commerce adoption include communication requirements (Sadowski et al., 2002; Downie, 2003), attitude toward e-services (Pollard, 2003), and perceptions of benefits (Mehrtens et al., 2001; Scupola, 2003).

These studies may help to explain why significant links have been found between the size of the firm and the intensity and/or level of involvement with information technology, with larger firms being quicker and more likely to adopt e-business technologies (Goode and Stevens, 2000; Lertwongsatien and Wongpinunwatana, 2003) and smaller firms being less likely to be involved with e-business or have a Web site (Martin and Matlay, 2001). Consequently, we propose:

P₁: Patterns of adopting e-business applications among SMEs will differ according to their size.

Research stream #2 is concerned with developing stage models that depict and describe the process of e-business adoption. Tornatsky and Fleisher describe the adoption of technological innovations as a three-stage process focused on initiation, adoption, and implementation (1990). According to their model, the initiation stage consists of collecting and analyzing information pertaining to the technological innovation, which concludes with a decision regarding which technology is to be adopted ("adoption") and introduced into the business ("implementation"). Sarosa and Zowghi's model (2003) is similar in concept, although

more detailed with respect to external assistance available to aid in implementation (i.e., vendors, government, consultants).

Several other researchers have developed theoretical models dealing with the stages of e-business adoption and implementation (e.g., Venkatraman, 1994; Chaffey et al., 2000; DTI, 2000; Forfás/National Competitiveness Council, 2000; Chaston and Mangles, 2001; Zhu et al., 2002; Rao et al., 2003). Venkatraman's model, designed for large organizations and widely cited in the literature, presents e-business transformation as proceeding through five levels, ranging from localized exploitation ("evolutionary level") to business scope redefinition ("revolutionary level"). The presumption of the model is that the higher a firm can reach, the greater will be the benefits derived despite higher levels of organizational change; however, the model is not conceptualized as linear "because effective strategies do not (and should not) follow any one prescribed model of evolutionary stages" (Venkatraman, 1994, p. 74).

Chaffey (2000) suggests a two-stage model to describe the level of e-commerce sophistication that an organization might possess. The higher level (Advanced) is distinguished from the lower (Primitive) level since it is characterized by full e-commerce implementation, including integrated order fulfillment, shipping, and billing. Giustiniano and Fratocchi (2002) suggest window sites, offline e-commerce sites, and online e-commerce sites as three stages of e-business development. Another model, developed by Andersen Consulting and cited in a Forfás study (2000) to the National Competitiveness Council in Ireland, describes the Internet adoption process as consisting of five stages: publish, interact, transact, integrate, and transform the business (Egan et al., 2003).

Finally, using cluster analysis, Daniel et al. (2002) identify four categories representing sequential steps or stages of e-business adoption in SMEs. According to the authors, "e-commerce is not a simple innovation; rather it is a cluster of separate innovations...

companies can choose which of these innovations they make use of and in what sequence" (Daniel et al., 2002, p. 254). Measuring usage of e-business applications as a binary variable (use/do not use) with the level of sophistication of e-commerce adoption being determined by summing up "usage" of the sixteen tested applications (maximum score = 16), their study showed that smaller firms tend to use relatively simpler, less sophisticated e-business applications, tending to occupy lower-level clusters, although the differences were not statistically significant.

The general picture that emerges from this literature is that firms initially adopt relatively simpler technologies and progress, with accumulated experience, to using more sophisticated and complex applications. Larger firms may be endowed with: (a) financial resources that can enable them to jump-start adoption of Internet technologies, and (b) human resources, especially IS/IT personnel, who can assist with their implementation. On the other hand, very small firms typically have negligible buying power and limited access to resources (Burpitt and Rondinelli, 2000). So while the Internet affords an opportunity to cost-effectively reach new markets and compete with much larger competitors, its cost must be balanced against available resources (financial and human), its ease in use (Davis et al., 1992), and so on. Given the barriers that smaller firms face in implementing Internet applications (e.g., lack of in-house IT expertise), we propose:

P₂: Larger SMEs will make greater use of more complex e-business applications while smaller SMEs will make greater use of relatively simpler e-business applications.

Research stream #3 focuses on the relationship between a firm's strategic orientation and its propensity to adopt e-business technologies. A firm's strategic orientation characterizes its patterns of behavior with respect to its responses to the external environment. Among various typologies that have been put forth in the

literature, the Miles and Snow (1978) typology has received the most attention in the empirical literature (Bahae, 1992) and continues to be employed today to measure strategy implementation in a variety of environments (e.g., McCann et al., 2001; Upton et al., 2001; Cunningham, 2002; Auger, 2003; Hatten et al., 2004).

Based on the intended rate of product-market development (new product development, penetration of new markets, and so on), Miles and Snow (1978) identified four strategic types: Innovators/Prospectors, Defenders, Analyzers, and Reactors. Innovators/Prospectors grow by developing new products and markets, and they are usually strong in and devote substantial resources to two broad areas of competence: (1) new product management, including use of new technologies; and (2) marketing. Defender businesses focus on maintaining their positions in established product-markets while devoting less attention to new product development. Analyzer businesses follow industry leaders closely while Reactors generally must be pressured by the market before making a change.

Along a similar vein, other researchers have applied Rogers' (1962) diffusion of innovation theory, or its extensions, to understand the process of e-business adoption (e.g., Thong, 1999; Lertwongsatien and Wongpinunwatana, 2003). Based on SMEs' e-commerce innovativeness, Lertwongsatien and Wongpinunwatana (2003) identified three groups (adopters, prospectors, and laggards), finding significant differences in several variables (e.g., top management support for e-commerce) across those groups.

Still other researchers use "entrepreneurial orientation" to describe firms that have an outward focus, are proactive and aggressive, vigorously pursue new opportunities, and are willing to take risks to find innovative solutions to challenges (Auger et al., 2003). Several studies conducted among small businesses have found evidence of a relationship between innovativeness and growth in sales, with entrepreneurial firms

more likely to experience greater sales growth than their non-entrepreneurial counterparts (e.g., Freel, 2000; Entrialgo et al., 2001). Two other recent studies found significant and positive differences between entrepreneurial-oriented firms and non-entrepreneurial in terms of their attitudes towards using the Internet, with the former more likely to be first-movers in e-business (Chaston and Mangles, 2001; Auger et al., 2003).

Upton, Teal, and Felan (2001) have construed an entrepreneurial orientation as consistent with Miles and Snow's (1978) Innovator/Prospector type (Upton et al., 2001). We operationalize strategic orientation using the Miles and Snow (1978) typology and propose:

P₃: SMEs' usage of e-business applications will differ according to the strategic orientation of the firm.

METHODOLOGY

The objective of this study was to explore the adoption of e-business tools among SMEs and to identify e-business applications benchmarks. The research was part of a comprehensive study conducted among small and medium-sized businesses in Western Michigan, a region of the U.S. that is noted for its rich history and prominence of small business ownership.

A six-page self-administered survey questionnaire was mailed to 4,000 SMEs (small and medium-sized enterprises) in the region as identified by a Dun & Bradstreet database. Using nominal scales, the first section was comprised of nine questions that sought to obtain general business and demographic information about the firm. Additionally, following previous work (e.g., McCann et al., 2001; Auger, 2003), this study measured how firms characterized their competitive business strategies according to the Miles and Snow typology (1978) by indicating which of the following statements best described their business philosophy:

- We stick to what we know how to do and do it as well or better than anyone else (Defender Strategy).
- We are innovators and are willing to take the necessary risks of providing new products and services (Innovator /Prospector Strategy).
- We do not want to be first in our industry to offer a new product or service, but we try to be close behind with a similar product or service that is competitive (Analyzer Strategy).
- We do not follow a specific program or plan for making us more competitive, although when we are faced with strong threats, we definitely make changes (Reactor Strategy).

A second section addressed the degree of importance that the firm placed on the use of a collection of Internet applications drawn from the literature (e.g., Griffith and Krampf, 1998; Kolesar and Galbraith, 2000; Burke, 2002; Lertwongsatien and Wongpinunwatana, 2003) using Likert-type scales to measure the importance level of each item (1 = Extremely Unimportant, 5 = Extremely Important). The final section queried respondents about their perceptions concerning the impact on net profit as a result of using the Internet. A five-point itemized rating scale was used (1 = Definitely Untrue, 5 = Definitely True). To encourage participation, a summary copy of the study results was offered to all who completed and returned the survey questionnaire.

FINDINGS

A total of 461 responses were received, of which 395 were usable. Sixty-six firms were excluded from the study: 50 failed to identify the size of their organization and 16 identified theirs as a large organization (more than 250 employees). As shown in Table 1, over 50 percent of responding organizations were micro enterprises. Following classifications used by Fornell et al. (1996), the data was also sorted according to the industry sectors in which the firms operated; approximately 20 percent of respondents

came from the retail sector, and nearly 14 percent from the services sector, with the remainder coming from construction, wholesaling and distribution, manufacturing, and other industries. Among the 395 SMEs, the mean age of the firm was thirty-one years. The majority of firms were family-owned (88.1%), in their first generation (68.7%), and were headed by a male (86.5%) between the ages of forty-five and fifty-four years (38.7%). During the previous fiscal year, 43 percent reported revenues of under \$1,000,000. Thus, the sample's demographic characteristics indicate that it appears to reflect the overall U.S. population of small businesses (U.S. Census Bureau, 2002; MassMutual, 2003).

e-Business Tools and Practices

Respondents were asked to indicate the level of importance their firm placed on the use of twenty-one e-business tools and practices relating to e-mail, research, marketing, and other purposes. To test the first proposition, ANOVA was used to examine differences in means across size gradations. The results, shown in Table 2, indicate significantly different priorities associated with four of the five e-mailing practices (sig. \leq .01), as well as using the Internet to meet the demands of a large customer or supplier (sig. \leq .05). In further analyzing these differences using t-tests, involvement with e-mailing was significantly different between micro (Mi) and small (S) firms, and micro (Mi) and medium-sized (M) firms, with respect to: current customers (Mi/S sig. = .004; Mi/M sig. = .019); customer service (Mi/S sig. = .001; Mi/M sig. = .001); support for channel partners (Mi/S sig. = .009; Mi/M = .024); and with employees (Mi/S sig. = .002; Mi/M sig. = .000). The same was true with respect to using the Internet to meet the demands of a large customer or supplier (Mi/S sig. = .035; Mi/M sig. = .031). On the other hand, comparisons between small and medium-sized firms yielded only one statistically significant difference: use of e-mail with employees (sig. = .031).

The finding that these differences predominantly occurred between micro and small firms and between micro enterprises and medium-sized firms, but *not* between

Table 1 - Size Profile of Sample
(N = 461)

| Size of Organization | n | Percent |
|-----------------------------------|------------|--------------|
| Micro enterprise (0-10 employees) | 231 | 50.1 |
| Small (11-50 employees) | 125 | 27.1 |
| Medium (51-250 employees) | 39 | 8.5 |
| Large (251+ employees) | 16 | 3.5 |
| Missing ^a | 50 | 10.8 |
| Total | 461 | 100.0 |

^a Fifty firms did not identify their number of employees.

Table 2 - ANOVA for SMEs' Usage of e-Business Applications
(N = 395, means shown, Scale: 1 = Not at all involved; 5 = Extremely Involved)

| e-Business Application | Size of Organization | | | Sig. |
|---|----------------------|-------|--------|------|
| | Micro | Small | Medium | |
| E-mail | | | | |
| E-mail – current customers | 2.91 | 3.42 | 3.53 | .004 |
| E-mail – prospective customers | 2.77 | 3.01 | 3.22 | .116 |
| E-mail – customer service | 2.77 | 3.33 | 3.58 | .000 |
| E-mail – support for channel partners | 2.30 | 2.73 | 2.88 | .008 |
| E-mail – employees | 2.32 | 2.87 | 3.47 | .000 |
| Research | | | | |
| Find information about competitors | 3.03 | 2.95 | 3.08 | .794 |
| Find information about new sources of supply | 3.42 | 3.48 | 3.28 | .690 |
| Find new markets or customers | 2.98 | 3.00 | 3.08 | .913 |
| Find other marketing data | 3.05 | 3.16 | 3.17 | .718 |
| Marketing | | | | |
| Enhance company image/brand | 3.25 | 3.59 | 3.47 | .108 |
| Target small or hard-to-reach markets | 2.80 | 2.64 | 2.81 | .596 |
| Online advertising (e.g., banner ads) | 2.17 | 2.04 | 2.22 | .569 |
| Real-time online interactions (i.e., chat rooms) | 1.76 | 1.56 | 1.74 | .245 |
| Online product demonstration | 2.09 | 2.15 | 2.19 | .856 |
| Online product delivery | 2.09 | 2.29 | 2.09 | .451 |
| Online ordering | 2.41 | 2.71 | 2.33 | .157 |
| Online order tracking | 2.27 | 2.28 | 2.17 | .893 |
| Other | | | | |
| Meet the demands of a large customer or supplier | 2.68 | 3.06 | 3.26 | .030 |
| General administrative uses (e.g., travel reservations) | 2.83 | 3.03 | 3.00 | .423 |
| Participate in discussion groups | 1.99 | 2.00 | 1.97 | .991 |
| Education/training | 2.66 | 2.72 | 3.17 | .106 |

small and medium firms seems to suggest that the upper bound on micro firms (10 employees) may represent a threshold level, above which usage of e-business technology assumes a higher priority. In all cases, too, the highest means were found among medium-sized firms, indicating that larger organizations attach greater importance and are more extensively involved with the use

of these e-business tools, thus lending support to our first proposition.

With respect to the second proposition, using chi-square analysis, this study found evidence of an association between the size of the firm and having a Web site ($X^2 = 69.479$, $df = 2$, $sig. = .000$). Overall, it appears that the larger the firm, the greater

the likelihood of having a Web site. While only 28.1 percent of micro firms had a Web site, 64 percent of small and 84.6 percent of medium-sized firms had a Web site, as shown in Table 3. Additionally, among those micro firms that did *not* have a Web site, 51 (54.2%) indicated that they planned to have one within the next six months, which was the highest percentage among the three size categories. This, combined with the aforementioned findings regarding SMEs' usage of e-business tools, suggests that while very small firms are using simpler technologies (e.g., search engines) at present, they recognize the importance of more sophisticated technologies, including e-mail and having a Web site, and plan to adopt them. As found by Daniel et al. (2002) in a study conducted among UK SMEs, firms in the first cluster ("Developers") tend to be smaller, both in terms of number of employees and turnover (i.e., sales revenue) than those in more advanced stages of e-business development. Thus, we find support for the second proposition that smaller firms tend to be in a development mode with respect to their e-business presence.

Innovativeness of the Firm

Previous researchers have found that family firms, which comprised a majority of respondents in this study, tend to adopt Defender and Innovator/Prospector business strategies because of either one of two conditions:

- Family firms can be very conservative in their business strategies because they often regard business income more as an annuity than as funds available for reinvestment in risky new products or services.
- Due to their relatively smaller size, greater local market knowledge, and relative financial independence compared to very large national companies, family firms can be very innovative and aggressive in their business strategies (McCann III et. al, 2001).

Based on the Miles and Snow typology (1978), the majority of responding SMEs (47 percent) indicated that their firm followed a "Defender" strategy, as shown in Table 4. Another 37.4 percent classified their business strategy as "Innovator." Chi-square analysis was used to test for differences in business strategy types according to SME categories. While the differences were not significant ($\chi^2 = 7.568$, $df = 6$, $sig. = .230$), two cells had frequencies less than 5, violating an assumption of the chi-square statistic. The data was re-analyzed, collapsing medium-sized firms into innovator and non-innovator categories, with no significant differences found. Thus, the Miles and Snow typology appears to be applicable across SME size categories.

To test proposition #3 for differences in usage of e-business technologies according to strategic orientation, ANOVA was used with the results shown in Table 5. It is interesting to note that statistically significant differences at $p \leq .05$ were found with respect to sixteen of the twenty-one applications, lending support to our proposition. With the exception of miniscule mathematical differences in means between Defenders and Innovators in the cases of online advertising, online ordering, and online order tracking, the highest means across all applications occurred within firms that identified themselves as Innovators.

Following this, and due to the low(er) frequencies in both Analyzer and Reactor categories in this sample [3], the data was re-coded into two categories – innovators and non-innovators – to test for differences across SME size gradations. Testing for significant differences using multivariate analysis of variance (MANOVA) between innovators and non-innovators and for each size category of respondents with respect to the importance of using e-business tools and practices resulted in several interesting observations. First, as shown in Table 6, statistically significant differences at $p \leq .05$ between innovator and non-innovator groups were found for all five e-mailing practices, three of the four research-related practices,

Table 3 - Web Site Profile
(N = 395)

| Web Site | Size of Organization | | | Total |
|----------|----------------------|------------|------------|-------------|
| | Micro | Small | Medium | |
| Yes | 65 (28.1%) | 80 (64.0%) | 33 (84.6%) | 178 (45.1%) |
| No | 166 (71.9%) | 45 (36.0%) | 6 (15.4%) | 217 (54.9%) |

Table 4 - Strategic Orientation Profile
(N = 395, column percentages shown for responders)

| Strategic Orientation | Size of Organization | | | Total |
|----------------------------|----------------------|------------|------------|-------------|
| | Micro | Small | Medium | |
| Defender | 100 (46.7%) | 59 (48.8%) | 16 (43.2%) | 175 (47.0%) |
| Innovator | 75 (35.0%) | 45 (37.2%) | 19 (51.4%) | 139 (37.4%) |
| Analyzer | 14 (6.5%) | 9 (7.4%) | 1 (2.7%) | 24 (6.5%) |
| Reactor | 25 (11.7%) | 8 (6.6%) | 1 (2.7%) | 34 (9.1%) |
| Missing (no reported data) | 17 | 4 | 2 | 23 |
| Total | 231 | 121 | 37 | 395 |

three of four general practices, and one of the marketing-related practices, lending support for the third proposition. Analysis of differences in means within groups using *t*-tests revealed that micro enterprises identifying themselves as Innovators placed significantly greater emphasis on using e-mail for a variety of purposes as well as for research, to enhance the company’s image/brand, to target small or hard-to-reach markets, and to participate in discussion groups. Among small firms, Innovators made significantly greater use of the Internet to communicate with both prospective customers and employees than did non-innovator firms, as well as for online product demonstration purposes and to participate in discussion groups. Innovator firms that were medium-sized used the Internet significantly more than non-innovator firms to communicate with channel partners, to find new markets or customers, for online ordering, to meet the demands of large customers or suppliers, and to participate in discussion groups.

So, what applications, if any, represent benchmarks (or “killer apps”) for SMEs? To answer that question, an analysis was conducted to determine if there were differences in use of e-business applications according to perceived impact of the use of

Internet technologies on business profits. Using ANOVA, differences in means ($p \leq .05$) were found with regard to twenty of the twenty-one applications (see Table 7). Additional t-tests for differences in the importance attached to using e-business applications, according to size of the firm, between those that did and did not perceive increased net profits as a result of using the Internet produced an identification of the “killer apps” for each SME size category (sig. $\leq .05$, flagged in Table 7).

DISCUSSION

The Internet offers SMEs the ability to increase sales and profits through enhancement of the firm’s image as well as vis-à-vis research and communications. As shown in Table 7, across all SME size categories, higher levels of involvement with an array of Internet technologies are associated with perceptions of increased profit. Those applications that appear to be particularly important in influencing profits (overall sig. $\leq .01$) include: four of the five e-mail applications, all research applications, all marketing-related applications aside from real-time online interactions (i.e., chat), participating in discussion groups, and using the Internet to meet the demands of a large customer or supplier.

Table 5 - ANOVA for Use of e-Business Applications according to Strategic Orientation
(N = 395, Scale: 1 = Not at all involved; 5 = Extremely Involved)

| e-Business Application | Strategic Orientation | | | | | | | |
|---|-----------------------|-------|-----------|-------|----------|-------|---------|-------|
| | Defender | | Innovator | | Analyzer | | Reactor | |
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| E-mail | | | | | | | | |
| E-mail – current customers *** | 3.12 | 1.436 | 3.45 | 1.390 | 2.70 | 1.302 | 2.36 | 1.254 |
| E-mail – prospective customers *** | 2.76 | 1.346 | 3.19 | 1.323 | 2.63 | 1.300 | 2.21 | 1.031 |
| E-mail – customer service *** | 3.06 | 1.395 | 3.35 | 1.354 | 2.63 | 1.165 | 2.11 | 1.031 |
| E-mail – support for channel partners *** | 2.53 | 1.354 | 2.84 | 1.388 | 2.21 | 1.032 | 1.75 | 0.752 |
| E-mail – employees *** | 2.47 | 1.356 | 3.25 | 1.564 | 2.30 | 1.261 | 1.93 | 1.052 |
| Research | | | | | | | | |
| Find information about competitors * | 2.93 | 1.295 | 3.28 | 1.203 | 2.80 | 1.005 | 2.64 | 1.311 |
| Find information about new sources of supply ** | 3.21 | 1.251 | 3.74 | 1.180 | 3.40 | 1.273 | 3.25 | 1.323 |
| Find new markets or customers *** | 2.80 | 1.277 | 3.40 | 1.249 | 3.15 | 1.461 | 2.50 | 1.262 |
| Find other marketing data** | 3.10 | 1.264 | 3.33 | 1.196 | 3.20 | 1.281 | 2.46 | 1.105 |
| Marketing | | | | | | | | |
| Enhance company image/brand | 3.32 | 1.338 | 3.61 | 1.321 | 3.40 | 1.142 | 2.96 | 1.315 |
| Target small or hard-to-reach markets * | 2.69 | 1.308 | 2.93 | 1.328 | 2.63 | 1.383 | 2.15 | 1.027 |
| Online advertising (e.g., banner ads) * | 2.23 | 1.249 | 2.19 | 1.171 | 2.05 | 1.099 | 1.48 | 0.802 |
| Real-time online interactions (i.e., chat rooms) * | 1.77 | 1.108 | 1.81 | 1.042 | 1.40 | 0.681 | 1.19 | 0.491 |
| Online product demonstration ** | 2.08 | 1.201 | 2.35 | 1.344 | 1.80 | 0.834 | 1.52 | 0.893 |
| Online product delivery * | 2.20 | 1.320 | 2.21 | 1.363 | 2.15 | 1.387 | 1.41 | 0.888 |
| Online ordering | 2.55 | 1.369 | 2.54 | 1.368 | 2.75 | 1.482 | 1.89 | 1.219 |
| Online order tracking | 2.34 | 1.375 | 2.32 | 1.278 | 2.35 | 1.461 | 1.71 | 1.182 |
| Other | | | | | | | | |
| Meet the demands of a large customer or supplier * | 2.79 | 1.472 | 3.12 | 1.393 | 3.05 | 1.572 | 2.19 | 1.470 |
| General administrative uses (e.g., travel reservations) | 2.83 | 1.247 | 3.16 | 1.311 | 2.75 | 1.251 | 2.81 | 1.272 |
| Participate in discussion groups * | 1.89 | 1.147 | 2.23 | 1.229 | 1.75 | 1.020 | 1.56 | 0.917 |
| Education/training | 2.60 | 1.342 | 2.87 | 1.322 | 3.20 | 0.951 | 2.69 | 1.158 |

* Sig. ≤ .05 ** Sig. ≤ .01 *** Sig. ≤ .001

Table 6 - e-Business Applications according to SME Category and Strategic Orientation
(N = 395, means shown, Scale: 1 = Not at all involved; 5 = Extremely Involved)

| e-Business Application | Size of Organization | | | | | |
|--|----------------------|------------|---------|------------|----------|------------|
| | Micro | | Small | | Medium | |
| | Innov. | Non-Innov. | Innov. | Non-Innov. | Innov. | Non-Innov. |
| E-mail | | | | | | |
| E-mail – current customers ** | 3.19 † | 2.68 | 3.66 | 3.24 | 3.78 | 3.13 |
| E-mail – prospective customers *** | 3.00 | 2.57 | 3.44 †† | 2.72 | 3.44 | 2.88 |
| E-mail – customer service ** | 3.03 † | 2.52 | 3.61 | 3.13 | 3.56 | 3.56 |
| E-mail – support for channel partners ** | 2.58 | 2.14 | 2.79 | 2.71 | 3.59 ††† | 2.00 |
| E-mail – employees *** | 2.77 †† | 2.03 | 3.38 †† | 2.58 | 4.00 † | 2.88 |
| Research | | | | | | |
| Find information about competitors * | 3.31 † | 2.80 | 3.00 | 2.93 | 3.28 | 2.69 |
| Find information about new sources of supply *** | 3.86 ††† | 3.12 | 3.62 | 3.40 | 3.50 | 2.88 |
| Find new markets or customers *** | 3.42 ††† | 2.65 | 3.19 | 2.87 | 3.39 † | 2.56 |
| Find other marketing data | 3.30 † | 2.86 | 3.12 | 3.19 | 3.33 | 2.81 |
| Marketing | | | | | | |
| Enhance company image/brand * | 3.51 † | 3.03 | 3.64 | 3.53 | 3.56 | 3.31 |
| Target small or hard-to-reach markets * | 3.05 † | 2.57 | 2.71 | 2.57 | 2.83 | 2.75 |
| Online advertising (e.g., banner ads) | 2.38 | 2.02 | 1.90 | 2.15 | 2.33 | 2.00 |
| Real-time online interactions (i.e., chat rooms) | 1.87 | 1.71 | 1.71 | 1.49 | 1.94 | 1.50 |
| Online product demonstration ** | 2.19 | 1.98 | 2.54 † | 1.96 | 2.56 | 1.81 |
| Online product delivery | 2.18 | 1.95 | 2.32 | 2.31 | 2.47 | 1.69 |
| Online ordering | 2.37 | 2.36 | 2.73 | 2.69 | 2.78 † | 1.88 |
| Online order tracking | 2.30 | 2.17 | 2.32 | 2.30 | 2.50 | 1.81 |
| Other | | | | | | |
| Meet the demands of a large customer or supplier * | 2.90 | 2.51 | 3.27 | 2.91 | 3.53 † | 2.69 |
| General administrative uses (e.g., travel reservations) * | 3.10 | 2.68 | 3.17 | 2.94 | 3.22 | 2.69 |
| Participate in discussion groups *** | 2.23 † | 1.82 | 2.32 † | 1.83 | 2.33 †† | 1.40 |
| Education/training | 2.89 | 2.48 | 2.68 | 2.79 | 3.28 | 2.87 |
| ANOVA: * Sig. ≤ .05 ** Sig. ≤ .01 *** Sig. ≤ .001 | | | | | | |
| t-tests: Innovators vs. Non-Innovators † Sig. ≤ .05 †† Sig. ≤ .01 ††† Sig. ≤ .001 | | | | | | |

Table 7 - Importance of Internet Applications According to Perceived Results of Using the Internet – Increased Profits
(Means shown)

| Internet Application | Increased Profits | | | Profits did not Increase | | |
|---|-------------------|---------------|-------------|--------------------------|---------------|--------------|
| | Micro n=24 | Small n=22 | Med. n=4 | Micro n=127 | Small n=87 | Med. n=30 |
| E-mail | | | | | | |
| E-mail – current customers *** | 3.71† | 4.38†† | 4.50 | 2.76 | 3.24 | 3.37 |
| E-mail – prospective customers *** | 3.50 | 4.00†† | 4.25 | 2.63 | 2.81 | 3.03 |
| E-mail – customer service *** | 3.50† | 4.19†† | 3.75† | 2.66 | 3.17 | 3.53 |
| E-mail – support for channel partners *** | 3.13† | 3.30 | 4.00 | 2.16 | 2.65 | 2.68 |
| E-mail – employees * | 2.83 | 3.27 | 4.00 | 2.26 | 2.81 | 3.50 |
| Research | | | | | | |
| Find information about competitors ** | 3.46 | 3.41† | 3.75 | 3.02 | 2.84 | 2.93 |
| Find information about new sources of supply *** | 3.96† | 4.14† | 3.75 | 3.39 | 3.38 | 3.20 |
| Find new markets or customers *** | 3.96†† | 3.91†† | 4.50† | 2.80 | 2.80 | 2.87 |
| Find other marketing data *** | 3.71 | 3.73 | 4.00 | 2.97 | 3.07 | 3.07 |
| Marketing | | | | | | |
| Enhance company image/brand *** | 4.38††† | 4.24 | 4.25 | 3.04 | 3.52 | 3.37 |
| Target small or hard-to-reach markets *** | 3.83†† | 3.50†† | 3.50 | 2.63 | 2.49 | 2.73 |
| Online advertising *** | 2.88†† | 2.40 | 2.25 | 2.00 | 1.93 | 2.23 |
| Real-time online interactions | 2.00 | 1.80 | 1.75 | 1.69 | 1.49 | 1.79 |
| Online product demonstration *** | 3.04††† | 2.60 | 2.50†† | 1.90 | 2.09 | 2.13 |
| Online product delivery *** | 3.23††† | 3.25†† | 2.25 | 1.88 | 2.10 | 2.03 |
| Online ordering *** | 3.50††† | 3.75††† | 2.75 | 2.19 | 2.49 | 2.27 |
| Online order tracking *** | 3.17††† | 3.05† | 2.50 | 2.08 | 2.16 | 2.13 |
| Other | | | | | | |
| Meet the demands of a large customer or supplier *** | 3.54† | 4.40††† | 4.25 | 2.52 | 2.85 | 3.10 |
| General administrative uses * | 3.08 | 3.73† | 3.00 | 2.84 | 2.90 | 3.00 |
| Participate in discussion groups *** | 2.79†† | 2.70† | 2.25 | 1.80 | 1.87 | 1.90 |
| Education/Training * | 3.13 | 3.05† | 4.00 | 2.61 | 2.66 | 3.07 |
| ANOVA: * Sig. ≤ .05 ** Sig. ≤ .01 *** Sig. ≤ .001 | | | | | | |
| t-tests: Innovators vs. Non-Innovators † Sig. ≤ .05 †† Sig. ≤ .01 ††† Sig. ≤ .001 | | | | | | |

However, as demonstrated in this study, distinct patterns exist for using e-business technologies depending on the size of the organization and the extent of its innovativeness.

With respect to the size of the organization (SME), this study finds that while using the Internet to locate information about new sources of supply and to enhance the company/image brand is important for all

firms, the smallest of firms attach greater importance to using the Internet for *research* purposes and lesser for *communication* reasons (i.e., e-mail). Thus, this study supports earlier findings (e.g., Levenburg and Dandridge, 2000; Pratt, 2002) that the most common reason for micro firms to use the Internet was to obtain information. In our study, the top-ranked e-business applications among micro firms were using the Internet to find new sources of supply ($\bar{x} = 3.42$, $s = 1.263$), suggesting that these firms may rely more on the Internet for “buying” reasons than for “selling.” It is also consistent with Martin and Matlay’s (2001) finding that smaller firms are less likely to have a Web site. This pattern among micro firms is reversed for larger (i.e., small and medium-sized) firms in which using Internet applications for all customer-related purposes (e.g., e-mail with current and prospective customers and for customer service purposes, or having a Web site) takes on heightened importance.

Consistent with Daniel et al. (2002), it appears as though very small firms are in the early stages of implementing e-business and tend to rely on simpler, easy-to-use technologies, placing particular importance on using the Internet for research purposes. As suggested by Tornatsky and Fleisher (1990), in adopting a technological innovation, the “initiation” (first) stage involves collecting and analyzing relevant information. For micro firms, determining whether or not to proceed to further stages of e-business development might well hinge on their evaluation of the perceived “usefulness” of information gained via their initial Internet forays (i.e., using the Internet to gain information pertaining to sources of supply, new markets, competitive information, and other marketing data) (Davis, 1989; Davis et al., 1992). If the technology innovation is perceived as *useful* to the firm (Davis, 1989) and offers *benefits* to the firm (Mehrtens et al., 2001; Scupola, 2003), the literature suggests that its adoption may proceed in a smoother and faster manner. Additionally, success with initial online ventures may inspire the firm to proceed to adoption of more sophisticated

technologies, including full e-commerce implementation, as suggested in several models (Chaffey, 2000; Forfás, 2000; Guistiniano and Fratocchi, 2002). In fact, this study demonstrates that among micro firms that are Innovators, substantial gains can be realized by reaching higher and deeper to incorporate strategic use of e-mail and to research markets and new sources of supply.

Small firms, while placing greater priority on using e-mail than micro firms, focus largely on e-mailing with *current* customers and providing them with customer service. Gains can be realized when using e-mail to communicate with *prospective* customers, as well as with employees. Finally, larger firms (medium-sized SMEs) tend to be the most sophisticated e-business technology users, as evidenced by the highest prevalence of a Web site and higher means for usage of e-business tools, as well as expanded purposes (e.g., to meet the demands of a large customer or supplier). For them, the next level of e-business development will likely be more transaction-oriented, including online product demonstration, online order tracking, delivery, and so on, as suggested by numerous researchers (e.g., Venkatraman, 1994, Chaffey, 2000; Forfás, 2000; Guistiniano and Fratocchi, 2000).

Moreover, in contrast to early projections that the Internet would enable small firms to “level the playing field” when competing with larger firms, several previous studies have found just the opposite, with advantages accruing to larger, rather than smaller, firms (e.g., Auger and Gallagher, 1997; Poon and Swatman, 1997; Hart et al., 2000; Jeffcoate et al., 2002). This study extends those findings and sheds light on prior conclusions by demonstrating that even among the population of SMEs, larger firms are likely to be better-poised technology-wise than smaller ones. Thus, while prior researchers’ assertions appear to hold true categorically, this study found significant differences in adoption of e-business applications and tools according to the size of the organization when more narrowly stringent definitions of small business are

employed. Thus, research reports that employ traditional definitions of small business (e.g., less than 500 employees) may fail to adequately detect the technology configurations and nuances in usage yielded by finer discriminations.

SUMMARY

Business consultants often advise their small business clients that if they want to survive, they had better be on the Internet (Alva 1999). In fact, it appears that an increasing number of small businesses are not only *on* the Internet, but are beginning to implement strategies to move from merely using "easier" Internet technologies, such as using the Internet for research and e-mail, to utilizing the Internet to accomplish marketing and business objectives.

The results of this study indicate that there are highly significant differences in the use of e-business applications among firms by size gradation. A general profile emerges of more sophisticated use of the Internet by both larger firms and those that consider themselves to be more innovative and entrepreneurial-oriented. The smallest of firms, challenged by human and physical resource limitations, engage in using e-business technologies that are relatively simple. While very few micro firms have a Web site, many perceive its importance in helping the firm to realize higher profits. Consequently, as their e-business experience and savvy grows, they may be led to adopt more complex and sophisticated applications.

The results reported herein suggest that while many small firms recognize the benefits of e-business, many do not. "Mom and pop" operations that employ few, if any, employees might, arguably, see little need for engaging in e-business; their small size and nature of operations may simply not justify the cost associated with even acquiring Web access. These distinctions suggest at least a partial explanation for small businesses' lag in adopting the tools of e-business. In the future, research opportunities may exist with regard to

examining these small business owners' propensities to invest in technology, rate of adoption, and "critical moments" in new technology decision making.

LIMITATIONS

The focus of this study was to understand differences and nuances in SMEs' use of e-business technologies according to discriminating size criteria and strategic orientation; no attempt was made to examine these differences according to industry sector. It is conceivable, however, that differences might occur between firms competing in various industries (i.e., manufacturing versus services) or even between firms competing within a specific sector. For example, within the services category, it seems reasonable to expect that a business that does not require face-to-face contact with customers to provide services (e.g., travel agencies, financial services, printing services) would make greater use of the Internet for business purposes than would a service that necessitates face-to-face contact (e.g., hair salon, dentist, or automobile body shop). Even if examined at the aggregated level, some useful characteristics of Internet use by various sub-groups of the services industry could be masked. Consequently, this suggests the need for a large-scale research study which accommodates detailed analysis according to industry sector.

Finally, the data used in this study was collected in the fall of 2001. Since then, technological possibilities and e-business opportunities have continued to evolve, and new formats for competing online will continue to emerge. This suggests the need for continuing research into SMEs' use of e-business applications (e.g., "old" technologies abandoned, new technology adopted).

NOTES

[1] Recently, the U.S. SBA's size standards were revised to match them to industries as defined by the North American Industrial Classification System (NAICS), as well as to

establish criteria based on revenue. With the exception of the wholesale trade, the size maximum for most sectors remains 500 employees. For retail and service sector firms, the maximum size can be as low as \$4 million (e.g., architectural firms) to \$6 million (e.g., furniture stores).

[2] Davis' model, commonly referred to as the Technology Acceptance Model (TAM), has been applied in many different contexts and has received substantial attention within the literature (e.g., Adams et al. 1992; Hauser and Simmie, 1981; Keil et al., 1995; Venkatesh and Davis, 1994; Pollard, 2003).

[3] In a study that applied the Miles and Snow (1978) typology to family businesses in Washington state, McCann III et al. (2001, p. 53) found similar percentages to ours for all four strategy types: Defenders (40%); Innovator/Prospectors (42%); Analyzers (11%); and Reactors (8%).

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