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DRIVERS OF INTERNET PURCHASING SUCCESS*

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The development of the Internet as a business tool over the past 5 years has been phenomenal, causing a period of chaos and creative destruction. E-commerce has been hyped as a catalyst for vast streamlining of the supply chain. Yet, in a time of such phenomenal change, the focus tends to be on the large picture. Many details of how a new technology should be or is employed tend to be unknown or ignored. However, as the technology matures and stabilizes, one of the primary factors that separate winners from losers is the way in which the technology is implemented and operated on a daily basis. This study examines the ways in which companies utilize the Internet to streamline their purchasing process.

A survey of 416 customers of a major Internet retailer of commodity office supplies reveals important relationships between web site design, employee work environments, Internet strategy, and purchasing performance. Our sample of companies consists of firms that have ordered office supplies at least once using the Internet. Our data indicate that companies do realize performance benefits from utilizing the Internet as a purchasing tool. Furthermore, the data suggest factors that facilitate purchasing process improvements. These factors can be utilized by both buying and selling companies to improve their proprietary processes to maximize the benefits of e-commerce as a purchasing tool.
(E-COMMERCE; PURCHASING; SUPPLY CHAIN MANAGEMENT; TECHNOLOGY MANAGEMENT; OPERATIONS STRATEGY)

1. Introduction

The past two decades have witnessed a revolution in the management of the supply chain. In order to be viable in today's hyper-competitive business environment, companies are increasingly turning to a more holistic, inter-business approach to managing key activities such as purchasing, new product development, logistics, and manufacturing. One of the most powerful tools for catalyzing process change throughout the supply chain has been information technology that allows organizations to track and analyze data comprehensively and quickly. In particular, electronic data interchange (EDI), originally developed in the late 1960s, allows companies to exchange information electronically with little or no need for human intervention to transform or input data. Despite the great potential of EDI for organizational transformation, actual results are quite mixed (Mukhodapadhyay, Kekre, and Kalathur 1995; Massetti and Zmud 1996). One of the major barriers to realizing the benefits of EDI has been the relatively large commitment of both financial and human capital necessary

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to implement systems that have generally been custom tailored to individual applications. In contrast, the Internet provides a more universal and easier to implement format that streamlines inter-organizational communication.

Many smaller companies are finding that they can utilize the Internet to achieve many of the same benefits associated with EDI without the need to make specialized investments in hardware, software, and support. For example, Pitney Bowes, a $4.2 billion per year manufacturer of postage meters, implemented a supplier web site to manage procurement of 25,000 items. While Pitney Bowes had previously employed both EDI and enterprise resource planning (ERP) systems, realizing the full benefits of these systems was difficult because small suppliers could not afford these expensive systems. For example, Ray Hill, vice president of product supply, notes "the guy who supplies our wood pallets has five employees. He's not going to go out and buy a mainframe just to do EDI with us. This problem has been addressed through the Internet, which allows smaller suppliers easier access to product planning and specification information" (Brown, Cronin, Harrington, and Hodges 1999).

This study will examine the ways in which purchasing agents employ the Internet to reduce cost, improve quality, and speed up deliveries. Numerous advocates have prophesied the benefits of Internet purchasing for both business-to-consumer applications (i.e., Etoys or Amazon) and business-to-business (B2B) applications. In recent months, the biggest area of discussion and growth for Internet business is these B2B applications. Various estimates for the exchange of goods and services online range from $2.7 trillion (Segal 2000) to $7.29 trillion in 2004 (Orenstein 2000). E-hubs, or stand-alone electronic B2B exchanges are predicted to streamline procurement in their respective markets (Kaplan and Sawhney 2000). Leading companies such as Ford, GM, and DaimlerChrysler (automobiles); Sears and Carrefour (consumer goods); and Chevron and Wal-Mart's McClane division (convenience store distribution) have all recently pursued major initiatives (Gurley 2000). Clearly, the B2B electronic marketplace is booming, yet results have been disappointing in the main. Thus, vital questions are (1) how much will this sector grow and change the way corporations do business and (2) what are the operational processes that most effectively utilize this technology?

2. Research Plan

The popular press has certainly jumped on the Internet bandwagon, with hundreds or even thousands of stories and articles published each month describing the wonders of e-commerce, the phenomenal growth in sales, and the numerous corporate ventures formed to exploit this technology. During the first half of 2000, hardly a day passed without the announcement of some new B2B venture. In a time of such phenomenal change, the focus tends to be on the large picture. Many details of how a new technology should be or is employed tend to be unknown or ignored. However, as the technology matures and stabilizes, one of the primary factors that separates winners from losers is the way in which the technology is implemented and operated on a daily basis. This study examines the ways in which companies utilize the Internet to streamline their purchasing process. Rick Adams, Vice President of Logistics Grainger, a major clicks and mortar MRO supplier, recently estimated that approximately 40% of the cost of purchasing indirect materials is the cost of processing orders. Grainger estimates that online purchasing has the potential to reduce this cost by 50%, thus reducing the overall cost of indirect materials by 20% (Adams 2000). It is this "potential" cost saving that we seek to verify and measure. We examine the actual processes used by companies purchasing online from an established and well-known company—Office Depot.

Office Depot is a leading retailer of office supplies, with 825 office supply superstores in 46 states and $11.6 billion in sales for 2000 (Office Depot 2001). More importantly, for the purposes of this study, Office Depot is also a leader in Internet sales, with both a relatively

lengthy (for Internet companies) and successful track record. They have been selling online for 5 years and have annual Internet sales of $849.5 million for 2000, on which they actually make a profit, unlike the vast majority of Internet only startups (Office Depot 2001). Office Depot is widely considered to be the leader in the online office supplies market (Troy 1999; Warner, Roth, Schonfeld, and Gunther 1999; Gulati and Garino 2000). Their goal is to move 30% of the orders from its business services division to the net.

Office Depot provides an excellent opportunity to study online purchasing patterns for several reasons. First, the company is a pioneer in this area and one of the few companies actually showing a profit on Internet sales—so they must be doing something right (Business Week 2001). Second, Office Depot sells to a cross-section of American business, from Fortune 500 firms to the mom and pop store in your neighborhood. This allows us to develop a well-stratified sample designed to compare the Internet usage patterns of a variety of businesses. Third, Office Depot stocks approximately 8,000 commodity type products. Their customers do not require highly specialized applications or products. Thus, the results of surveying Office Depot's customers are readily generalizable to the population of American business as a whole. Finally, Office Depot straddles the line between B2B and B2C applications. It deals directly with large, Fortune 500 firms, using customized applications that can be considered B2B sources of MRO office supplies. It also deals with much smaller businesses with fewer employees that are more characteristic of B2C transactions. Office Depot thus offers a view of both the B2B and B2C sectors.

The main goal of this research is to examine the ways in which e-commerce can streamline the purchasing operations of companies that buy supplies online. We seek to identify areas where online commerce is quicker, more accurate, less time consuming, or provides better quality service. We also examine techniques or factors that influence the success of online commerce, such as strategic goals, level of technology knowledge, and Internet site design. The objective is to profile the benefits companies obtain by conducting purchasing over the Internet and to identify some of the factors that influence the success or failure of these activities.

3. Research Questions

This study seeks to explain the factors that lead to performance improvement when employing the Internet as a purchasing tool/technology. Our research questions are organized according to our general theoretical model, as shown in Figure 1. This model indicates that there are two broad groups of factors that predict performance improvements resulting from Internet applications. Each of these groups is examined in more detail below.

The specific research hypotheses associated with purchasing company and Internet factors are described below and shown in Figure 1. The scales and individual questions used to measure each construct are discussed in Section 5.

3.1 *Purchasing Company Factors*

Figure 1 outlines our belief that there are two groups of factors within the purchasing company that affect both its intention to adopt the Internet as a purchasing tool and its relative performance with these tools. The first of these factors, strategy, is based on a long stream of research in operations strategy that suggests that companies pursue different competitive priorities. The generally accepted model is that companies will make different operational decisions in areas such as technology and sourcing, depending on the specific competitive priorities they choose to emphasize (Hayes and Pisano 1996; Schmenner and Swink 1998). Clearly, one application of this model involves matching strategic priorities and the decision to use the Internet as a purchasing (sourcing) medium. In particular, we assess three strategic goals: (1) reducing cost or improving convenience/delivery, (2) improving the administration of purchasing transactions, and (3) improving the delivery accuracy, service, and security.

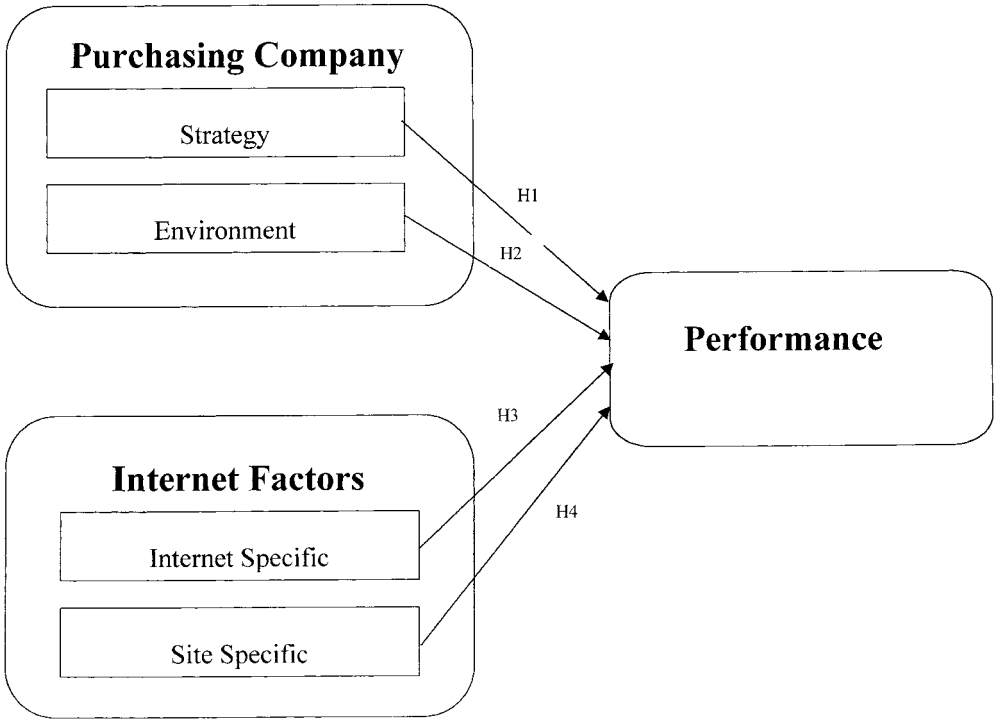

FIGURE 1. A Model of Factors that Affect Performance when Utilizing the Internet.

The items used to assess these strategic priorities are discussed below in the section on scales. The operations strategy literature suggests that clearly specifying strategic goals is a key first step in effectively implementing and utilizing any new technology, whether it is an FMS system, new inventory management system, or a new type of production equipment (Hayes and Wheelwright 1984; Hayes and Pisano 1996; Voss and Winch 1996; Boyer and McDermott 1999). The relationship between the three types of strategies described above and two types of performance has not been examined with respect to online purchasing. Specific strategies we examine include (1) common goals, (2) administrative efficiency, and (3) delivery. We test the following hypotheses:

Hypothesis 1. *Specific strategies for utilizing Internet purchasing are positively correlated with improved performance*.

The second set of purchasing company factors pertains to the environment employees work in. Specific environmental factors that are believed to facilitate new technologies include technology champions, training, a high degree of comfort with computers, and good technical support. Research on advanced manufacturing technologies has indicated that having a champion at a high level of the company who strongly promotes a particular technology may foster similar support by others and create an environment more conducive to success (Chen and Small 1996; Hottenstein, Casey, and Dunn 1997; Zhoa and Co 1997). According to Co, Patuwo, and Hu (1998), champions help companies achieve high performance by providing a positive and holistic outlook that may smooth implementation. The importance of a champion is implicitly linked with the level of that person in the company, thus the adoption level or level in the company at which the person who makes the adoption decision operates is also a critical success factor. Similarly, training has long been considered to be critical for properly supporting new technologies such as advanced manufacturing technology and developing an increased comfort level (Boyer, Leong, Ward, and Krajewski

1997). Finally, technical support is an important factor in encouraging use of the Internet; after all, no matter how much experience or training a person has had, computers still manage to mysteriously do strange things! Technical support has been shown to be an important environmental factor in the adoption of numerous MIS systems (Compeau and Higgins 1995). These findings have not been tested with regard to online purchasing. Specifically, we test the following environmental factors—comfort level with computers, the existence of a technology champion, the amount of technical support, and the amount of computer usage per week. We test the following hypotheses:

Hypothesis 2. *A working environment that supports computer and Internet usage is conducive to improved performance.*

3.2 *Internet Factors*

Figure 1 shows two groupings of Internet factors thought to affect performance when employing the Internet for purchasing. Internet-specific factors are underlying components that assess the respondent's general perceptions of Internet purchasing. These factors include perceived ease of use, perceived usefulness, and attitude, all of which our adopted from the technology acceptance model (TAM) of Davis, Bagozzi, and Warshaw (1989). This model was originally developed for IT applications to predict the adoption of specific innovations. These factors have been shown to accurately predict a wide range of technology adoptions. While the TAM was originally applied to measure individual intentions, our application focuses also on firm intentions. We believe that it is extremely difficult to separate individual differences from company to company differences, particularly since individuals serve as technology champions, users and shapers of corporate policies. In a classical sense, a strategy may be developed for the entire firm, but it is individuals that are responsible for implementing a technology.

Another slight modification of the TAM model involves assessing performance rather than intention to use. Prior applications of TAM have primarily been used in the IT field to predict the intention to use or actual usage of a particular technology; there is a precedent for utilizing the model to directly predict performance (Lucas and Spitler 1999). In particular, we seek to directly predict performance assuming that the technology is currently being utilized, a situation we have already guaranteed by selecting only companies that have placed orders over the Internet using Office Depot's web site. We therefore employ the TAM to predict performance improvements associated with Internet purchasing.

Hypothesis 3. *Internet specific factors such as perceived ease of use, perceived usefulness, and attitude are correlated with improved performance.*

We also seek to measure specific aspects of Office Depot's web site. The belief here is that the particular web site design is an important factor in predicting both usage and success (Meister, Patel, and Fenner 2000). While it seems obvious that careful design of a web site is critical to success, many of the guidelines available are based primarily on intuition and common sense, with little or no experimental validation (Dalal, Quibble, and Wyatt 2000). Even such "obvious" rules of thumb as keeping the web site simple to use, accurate, fast, and reliable are often either not followed or the magnitude of the relationship between site features and performance is not known. Therefore, we assess the impact of several specific features of a web site that we believe affect usage and performance: ease of use, the accuracy of information on the site, and the reliability of transactions.

Hypothesis 4. *Site-specific factors particular to an individual web site* (*including site ease of use, accuracy, and transaction ease*) *are associated with performance.*

4. Research Methodology

Data was collected from customers of Office Depot that had placed at least one order using Office Depot's web site within the prior year. Data collection occurred during May through August 2000. Our initial database of contacts consisted of approximately 65,000 customers from Office Depot's Business Services Division. Since they had fairly extensive internally collected data regarding their larger customers, Office Depot asked us to focus on smaller companies of 100 or fewer employees. The resulting initial database represented a very high quality sample since all of the companies had current mailing information and a fairly substantial amount of descriptive information, including the total dollar volume of business done with Office Depot over the past year, the total dollar volume of Internet orders, the number of orders, and the number of orders placed over the Internet. This information was used to design a stratified sample of customer contacts. Our first step was to compute an Internet usage variable (percent Internet orders) by dividing the number of Internet orders over the past year by the number of all orders per year. We then randomly sampled to select firms in several categories. Table 1 shows the categories selected and their representative proportions. Category A is of interest because these customers have all tried Internet ordering once, but have primarily used traditional ordering by phone or fax for the bulk of their orders. Category B is of interest because these customers have ONLY ordered over the Internet, with no orders placed via traditional methods (phone, fax, or mail). However, this group of companies consists of single orders with no repeat purchases. There were over 30,000 companies in this category. This was likely due to one of several Office Depot promotions encouraging the use of their Internet site. However, it would appear that this group of customers did not like the experience. Our selection of seven categories and number of contacts within each category is subjective in nature, with the primary goal of avoiding a preponderance of respondents such as the "once and gone" companies in category B. Category G is of interest because these customers conduct business exclusively over the Internet. There were approximately 17,000 of these companies that had multiple orders and conducted all of their business with Office Depot over the Internet. In all cases, when choosing companies to contact, we first sorted by last transaction date and then randomly

TABLE 1

Initial Contact Sample and Return Sample

Category	Number of Companies in Initial Database	Contact Sample: Surveys Sent			Surveys Returned		Criteria Used in Selection
		Total	Print	Computer	Print	Computer	
A	4,238	160	96	64	47.9%	40.6%	Single orders over Internet Multiple major office supplies retailer orders Small % of Internet orders >$100 per order
B	32,210	157	97	60	35.1%	33.3%	Single Internet orders No other major office supplies retailer orders
C	2,461	175	104	71	44.2%	40.8%	10–25% Internet orders
D	2,211	166	102	64	42.2%	31.3%	25.1–50% Internet orders
E	3,864	129	74	55	37.8%	32.7%	50.1–75% Internet orders
F	2,985	128	76	52	40.8%	46.2%	75.1–99% Internet orders
G	17,438	130	79	51	41.8%	35.3%	100% Internet orders More than 1 order
Total	65,407	1,045	628	417	41.4%	37.2%	

selected firms that had placed orders within the last few months. Table 1 outlines the categories and the criteria used to select companies.

Finally, we selected 2,000 names because Office Depot decided to e-mail these customers and ask if it was OK for us to contact them. Those who responded no were deleted from the list. This was done to uphold Office Depot's privacy policy regarding customer information not being sold or given away. Less than 5% of the customers pre-contacted by email noted that they did not want to be included in the study.

The next step involved pre-testing the survey instrument. We contacted three companies that agreed to fill out the pre-test and participate in a short interview regarding its readability and provide suggestions for improvement. Several useful suggestions were obtained regarding wording of questions and presentation of the survey.

The full survey was conducted using two methods. First, approximately 60% of the sample was contacted with a traditional printed survey (four pages in length), accompanied by a cover letter explaining that we would provide participants with a survey summary and a $15 rebate bonus. The cover letter also explained that we would keep all results anonymous and only report aggregate findings. Office Depot also provided a letter stating their interest in the study and explaining that the authors were acting as independent, non-biased third party researchers. The second data collection method involved using a computer survey program named Sensus. This program allows a written survey instrument to be coded on a floppy disk using fairly simply programming rules. The advantages of a computer-administered survey include the ability to add more detailed descriptions to questions, tailor the questions more precisely (for example we used 7-point Likert scales that allowed respondents to answer in half-point increments), add pictures and color formatting, and most importantly, Sensus records the data directly on the disk. The data can then be read directly into any database program such as Excel or SPSS.

We sent out a total of 1,045 surveys in our first round of mailings. Several steps were taken to increase the response rate, including the inclusion of a business reply envelope, an incentive to complete the survey, and the use of several follow-up letters. The first reminder letter was mailed 2 weeks later, re-emphasizing the confidential nature and importance of the survey. A second follow-up letter and a second copy of the survey were mailed to companies that had not filled out the original after 6 weeks. Very few (less than 5%) of the mailings were returned due to incorrect addresses or the contact person having left the company. This high accuracy rate is due to the currency of the database we received—most of our contact list had conducted business with Office Depot within the last 6 months.

The final tally consisted of 416 usable responses out of 1,045 total surveys, representing a 39.8% response rate. The response rates for the printed (261/631 = 41.4%) and computer version of the survey (155/414 = 37.4%) were almost identical. The overall response rate is higher than that seen in similar studies (Boyer, Leong, Ward, and Krajewski 1997; Duray, Ward, Milligan, and Berry 2000; Kathuria 2000). To assess non-response bias, we conducted chi-square tests on the proportion of positive responses for two categorical variables: the percent of Internet orders used to stratify the initial sample (seven categories, labeled A–G) and industry membership (17 categories, self-typed by customers when ordering). Neither test revealed a significant difference. Thus, based on these tests and the relatively high response rate, there does not appear to be evidence indicating a response bias in the data. Table 2 shows the breakdown of respondents across industries (the industries were defined by Office Depot and self-typed by customers). Table 3 provides an overview of the respondents. The companies tend to be very small, since our initial contact sample consisted of companies chosen to represent smaller companies (less than 100 employees). Note that there are a handful of substantially larger companies in our sample (200 or more employees), thus the large differences between means and medians in Table 3 (for example the mean total employment is 202.9, while the median is 13).

TABLE 2
Industry Membership

Industry	Number	Percentage
Education/schools	4	1.0%
Business services	37	9.0%
Membership/organizations	19	4.6%
Wholesale trade	24	5.8%
Accounting	3	0.7%
Social services	7	1.7%
Medical/health services	7	1.7%
Retail/restaurants	21	5.1%
Transportation/communications/utilities	12	2.9%
Real estate	12	2.9%
Legal	14	3.4%
Government	6	1.5%
Engineering/architecture/consulting	41	10.0%
Manufacturing/printing	26	6.3%
Insurance	11	2.7%
Construction/contractors	12	2.9%
Finance	14	3.4%
Missing/other	141	34.3%
Total	411	100.0%

5. Scales

This section describes the scales used to measure the various components of Figure 1. We used existing scales where possible, but also tried to develop customized scales where appropriate to capture the dynamic and customized nature of the Internet. Each of the factors shown in Figure 1 is described below, while Table 4 gives the means, SDs, and Cronbach's alphas (for the entire data sample and separately for the computer/printed versions). The individual items included in each scale are shown in the Appendix. All final scales are formed by computing the mean of the items comprising that scale.

TABLE 3
Profile of Survey Respondents

	Mean	SD	Median
Total employment	202.9	1103.1	13
Purchasing employment	3.3	17.4	(97.8% < 10)
Years in workforce	16.8	10.9	15.0
Years with current company	6.0	5.9	4.0
Years in current position	4.8	4.8	3.5
Business Located in			
Single Location	276	68.8%	
Multiple Locations	125	31.2%	
Total	401	100.0%	
Education level			
High school	131	32.7%	
Two-year degree	102	25.4%	
Four-year degree	114	28.4%	
Graduate degree	54	13.5%	
Total	401	100.0%	

TABLE 4
Descriptive and Reliability Data for Scales

	Mean	SD	Cronbach's α All	Print	Computer
Intorders	3.72	6.04	NA		
Strategy					
Goals	5.72	1.13	0.63	0.63	0.64
Admin	5.04	1.37	0.79	0.79	0.81
Delivery	5.69	1.28	0.80	0.80	0.80
Environmental					
Comfort	5.16	1.24	0.90	0.89	0.92
Tech support	4.76	1.95			
Adopt level	2.70	1.95	0.85*	0.92*	0.74*
Computer hours per week	26.96	11.54			
Training hours per year	8.42	23.95			
Site specific					
Site ease	5.37	1.18	0.89	0.90	0.87
Accuracy	5.36	1.08	0.87	0.81	0.84
Transact	5.34	1.27	0.65	0.70	0.56
System	5.25	1.08	0.87	0.87	0.88
Internet specific					
Percuse	4.93	1.49	0.96	0.96	0.97
Percease	5.36	1.32	0.93	0.94	0.91
Attitude	5.44	1.33	0.89	0.88	0.90
Performance					
Costperf	4.14	0.81	0.42*	0.50*	0.29*
Perfacc	4.53	0.88	0.50*	0.47*	0.57*

* Represents a scale with only two items. Cronbach's α is not applicable, so these are Pearson correlations.

5.1 *Purchasing Company Factors*

This category is divided into two sub-groups of scales. The strategy scales assess the priorities or objectives that drive companies to adopt Internet purchasing. In contrast, environmental factors measure the underlying capabilities and attitudes that affect this choice.

5.1.1 STRATEGY. We developed three scales to measure the reasons companies chose to employ Office Depot's web site. Goals consists of three items measuring the importance of cost, convenience, and delivery speed. Admin consists of four items assessing the importance of various standard purchasing administrative functions. Delivery includes three items relating to order accuracy, customer service, and security of the system. These items are fairly similar to each other, but include important differences in connotation. For example, goals appears to be a more general assessment of the overall speed and cost of the Internet ordering system, while admin assesses more of the detailed administrative aspects. Similarly, delivery includes aspects relating to the physical movement and interaction, in addition to electronic only transactions. As shown in Table 4, all three strategy scales are higher than the 0.60 threshold value for Cronbach's alpha that indicates sufficient inter-item reliability for new scales (Nunnally 1978; Flynn et al. 1990). Furthermore, the Cronbach's alphas are remarkably similar for the print and computer versions of the survey, thus indicating a high level of consistency between methods.

5.1.2 ENVIRONMENTAL. The environmental factors seek to capture elements of a company's culture that affect its usage of Internet purchasing. We initially asked seven Likert scale questions and two open-ended questions (the number of hours per week spent working on a

computer and the number of hours of training for computer activities per year). A factor analysis of the seven Likert scale questions indicated that they formed multiple constructs. Thus, we formed three constructs: comfort consists of four items relating to the individual's comfort level with computers in general and the Internet in particular, adopt level consists of two items regarding if the decision to use online ordering and which web site to use is made by higher level managers, and a single item, labeled tech support. The Cronbach's alpha for comfort is quite high, while the correlation for the two items comprising adopt level is also quite high. It is interesting to note that the average value for adopt level is very low (2.70), suggesting that the decision to use Internet ordering is very localized, at least in this sample of fairly small companies. This decision may be made in a more centralized fashion at higher managerial levels by larger companies.

5.2 *Internet Factors*

We divide the Internet factors that affect performance into two categories. Site-specific factors are those that are a direct result of the specific Internet site being used. For example, these items would be expected to vary depending on whether Office Depot or Office Max was the company being studied. Internet-specific factors can be considered as underlying components that assess the perceptions of the Internet purchasing in a more general manner.

5.2.1 Site Specific. We developed a list of 17 items that referred to specific aspects of a particular Internet site (in this case Office Depot). These items are generalizable since they can be changed to refer to different web sites simply by changing the name. An exploratory factor analysis showed eigen values of 6.07, 1.80, and 1.75 for the first three factors, so we ran a varimax rotation for the three factors. We then retained items that had loadings of 0.40 or higher on a single factor. The resulting factors were site ease, with items relating to the ease to navigate and load the site; accuracy, with items relating to current prices, promotions, in-stock status, etc.; and transact, which includes items on billing and order placement. There were three items that did not load on a specific factor and were thus dropped from further analysis. Each of these three scales has a Cronbach's alpha above 0.60. A fourth site-specific scale, system, is comprised of more general items regarding features of the Internet system. These questions do not refer specifically to Office Depot, but still predominantly apply to a specific site.

5.2.2 Internet Specific. We employ three scales adopted from the TAM developed by Davis, Bagozzi, and Warshaw (1989). The scales are adopted unchanged from Agarwal and Prasad (1999), with the sole change being the reference to "Internet purchasing" as the technology being addressed. Perceived ease of use (Percease) was originally defined as the extent to which the target technology's use or implementation is free from undue effort on the part of the end user. Perceived usefulness (Percuse) is defined as a potential user's subjective views of the new technology as offering benefits relative to alternative methods of performing the same task. Attitude measures more general feelings regarding the technology.

Although these scales have not been applied previously to study Internet purchasing, they are easily adapted for this usage because of their generalizable design and a prior record of successful application in a variety of fields. There are three substantive differences between prior applications and our application of these scales. First, all three scales have been successfully applied in numerous settings with numerous technologies including information technology (Davis, Bagozzi, and Warshw 1989), bank broker workstations (Lucas and Spitler 1999), and voice mail systems (Straub, Limayem, and Karahanna-Evaristo 1995). Thus, they are easily adapted to new technologies and applications and are well suited for our present study. Second, while most previous applications of these scales were primarily intra-organizational—dealing with the exchange of information within a single organization—other studies have taken a more inter-organizational approach, dealing with the exchange of information between multiple organizations and/or individuals (Lucas and Spitler 1999). We

adopt these scales to measure an inter-organizational application of information technology that seeks to reduce uncertainty and communications barriers/costs in the supply chain. In short, Internet purchasing essentially blurs organizational barriers by reducing the costs and difficulties of placing orders. Finally, the original items and scales, as developed by Davis et al. (1989), focus on individual perceptions of a technology. As applied in this study, the scales refer to a single purchasing organization as seen through the eyes of individual respondents. It is extremely difficult to parcel out "organizational" from "individual" beliefs and effects when studying a ubiquitous technology such as the Internet. Thus, we proceed with the assumption that individual beliefs play a central role in the implementation of any technological innovation, particularly in this case, where individual users are free to choose different methods of ordering supplies (either in terms of supplier (e.g., Office Depot or Staples) or in terms of method of ordering (phone, fax, mail, personal visit). As shown in Table 4, the reliability for these scales is very high. The specific items in each scale are shown in the Appendix.

5.3 *Performance Factors*

Performance is measured using two scales developed to assess the effect of Internet purchasing with respect to cost and accuracy of accounting. For example, costperf assesses the degree to which the Internet improves general purchasing cost and personnel training costs. Note that this variable is reverse-scaled and the mean shown in Table 4 has already been reversed. Thus, the 4.14 mean for costperf indicates that the general feeling is that there is a general improvement in cost. Perfacc deals more with accounting issues, including billing accuracy and availability of supplies and materials. Similarly, this measure indicates a general belief that the Internet directly improves performance. While these items are, by necessity, subjective in nature, their validity is buttressed by a more objective assessment—repeat purchases. A comparison of the means for each of the performance measures for respondents that have only purchased once over the Internet versus those that have multiple online purchases indicates that the multiple order group has significantly higher performance. Table 5 shows an ANOVA with the number of Internet orders placed by each customer as the independent variable and our two subjective performance measures as dependent variables. Table 5 indicates that all of the subjective performance measures are positively related to the more objective measure of repeat Internet ordering. In addition, the correlations between the two items comprising costperf and perfacc are quite high (0.42 and 0.50, respectively), suggesting a high degree of inter-item reliability.

6. Results

Table 6 shows the correlations between each of the scales described in the previous section. The strategy, environmental, site-specific, and Internet-specific scales are used as independent variables in stepwise regressions to predict each of the performance variables. We utilize stepwise regression to select the independent variables that have the greatest

TABLE 5
ANOVA for Number of Internet Purchases

	Number of Internet Purchases in Last 12 Months from Office Depot			
	Low (1)	Medium (2 or 3)	High (4 or more)	*P* value
Costperf	4.08	4.07	4.29	$P < 0.05$
Perfacc	4.49	4.41	4.69	$P < 0.05$
n	146	134	123	

TABLE 6

Correlations Between Scale Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Strategy																	
(1) Goals	1.00																
(2) Admin	0.50**	1.00															
(3) Delivery	0.54**	0.62**	1.00														
Environmental																	
(4) Comfort	0.05	0.04	−0.01	1.00													
(5) Tech support	0.03	0.14**	0.09	0.18**	1.00												
(6) Adopt level	0.09	0.06	0.06	0.02	0.15**	1.00											
(7) Computer hours per week	0.13**	0.08	0.06	0.20**	0.06	0.05	1.00										
(8) Hours training per year	0.05	0.09	0.05	0.05	0.13*	0.08	0.08	1.00									
Site specific																	
(9) Site ease	0.26**	0.33**	0.22**	0.06	0.11*	0.03	0.04	0.07	1.00								
(10) Accuracy	0.26**	0.20**	0.16**	0.05	0.08	0.03	0.01	0.11*	0.54**	1.00							
(11) Transact	0.05	0.10*	0.06	0.07	0.03	−0.02	0.03	0.04	0.44**	0.31**	1.00						
(12) System	0.36**	0.41**	0.29**	0.11*	0.11*	0.04	0.05	0.09	0.78**	0.61**	0.48**	1.00					
Internet specific																	
(13) Percuse	0.25**	0.43**	0.17**	0.28**	0.28**	0.16**	0.15**	0.05	0.45**	0.32**	0.29**	0.54**	1.00				
(14) Percease	0.24**	0.36**	0.21**	0.35**	0.15**	0.09	0.06	0.08	0.60**	0.38**	0.44**	0.68**	0.62**	1.00			
(15) Attitude	0.25**	0.41**	0.22**	0.24**	0.13*	0.09	0.11*	0.08	0.61**	0.40**	0.40**	0.70**	0.69**	0.68**	1.00		
Performance																	
(16) Costperf	0.07	0.13**	0.04	0.11*	0.17**	0.02	0.20**	0.11*	0.12*	0.14**	0.20**	0.23**	0.30**	0.19**	0.28**	1.00	
(17) Perfacc	0.27**	0.36**	0.25**	0.09	0.08	0.03	0.05	0.08	0.31**	0.28**	0.10*	0.38**	0.37**	0.29**	0.32**	0.10*	1.00
Control																	
(18) Intorders	0.08	0.12*	0.11*	0.06	0.05	0.05	0.01	0.05	0.10	0.00	0.02	0.06	0.12*	0.11*	0.11*	0.08	0.06

* $P < 0.05$.

** $P < 0.01$.

impact on each dependent variable because there is a high degree of collinearity and most of the independent variables are significantly correlated to the performance variables.

As shown in Table 6, most of our independent variables (including strategy, environmental, site-specific, and internet-specific factors) are significantly correlated with our performance measures. As noted above, we want to obtain the strongest predictors of performance while accounting for collinearity effects; thus, we employ stepwise regression. The stepwise regression is computed by entering all 15 independent variables into the SPSS software with the rule that a variable entering the regression equation must have a P value less than 0.05 and that variables that have a P value >0.10 after other variables are entered will be removed from the final equation. Table 7 shows the final regression model with beta coefficients and significance values for each variable. The variable intorders (number of Internet orders placed with Office Depot) is used as a control variable. It is relevant to note here that the sample sizes vary somewhat between Tables 2, 3, and 7—this is because of missing values; in each analysis, we have reported results for the sub-sample that has responses for all items in that analysis.

The models used to predict cost performance and accounting performance are both significant ($R^2 = 0.13$ and $R^2 = 0.21$, respectively). In both models, Internet-specific factors (particularly percuse) have a large impact. The model for cost performance includes one environmental factor, computer hours per week, while the model for accounting performance includes two strategic factors. It makes sense that the amount of time spent on the computer per week predicts cost performance improvements well, since one of the items in this scale

TABLE 7
Regression Equations for Performance

A. Stepwise Regression for COSTPERF

Variable	*b*	*t*	Calibration Sample (Printed Surveys)	Validation Sample (Computer Surveys)
Constant	2.92	16.39**	2.60*	2.60*
Intorders	0.01	0.06	0.03	0.01
Percuse	0.08	2.32*	0.10*	0.10*
Computer hours per week	0.01	3.00**	0.02**	0.02**
Attitude	0.10	2.55*	0.10*	0.10*
	$R^2 = 0.13$	$F = 18.03$**	$R^2 = 0.20$**	$R^2 = 0.05$**
		$n = 364$	$n = 248$	$n = 151$

$n = 364$.
* $P < 0.05$.
** $P < 0.01$.

B. Stepwise Regression for PERFACC

Variable	*b*	*t*	Calibration Sample (Printed Surveys)	Validation Sample (Computer Surveys)
Constant	2.24	8.35**	2.25**	2.25**
Intorders	0.02	0.36	0.04	0.01
Percuse	0.13	4.03**	0.14**	0.14**
Admin	0.10	2.73**	0.14**	0.14**
Accuracy	0.12	3.01**	0.10**	0.10**
Goals	0.09	2.17*	0.07**	0.07**
	$R^2 = 0.21$	$F = 23.47$**	$R^2 = 0.22$**	$R^2 = 0.21$**
		$n = 364$	$n = 255$	$n = 151$

* $P < 0.05$.
** $P < 0.01$.

is the cost of training new personnel. Similarly, it makes intuitive sense that strategic goals such as admin correlate well with accounting performance, since they deal with very similar subjects on a pre- and post-facto basis.

A common method for further testing the validity of a regression analysis involves developing an estimate of the regression coefficients using a calibration or training sample and then testing how well the same coefficients work for a separate holdout or validation sample. If the regression function derived from the calibration sample performs well in predicting the dependent variable for an independent validation sample, then the regression model is shown to have good generalizability (Johnson and Wichern 1988). Therefore, we employed the group of respondents that completed a paper (printed version) survey as our calibration sample and the group of respondents that completed the computer version of the survey as the validation sample. Two regression models utilizing the independent and dependent variables shown on the lefthand side of Table 7 were developed utilizing only the calibration sample. The regression coefficients from these models are then applied to the validation sample to predict the dependent variable. The righthand side of Table 7 shows the coefficients derived from the calibration sample and the resulting R^2 values for both samples for each of the dependent variables. The validation sample explains a significant amount of variance for each of the dependent variables, thus providing evidence for the validity of the regression models. However, the difference in R^2 values for the costperf dependent variable is substantial ($R^2 = 0.20$ for the calibration sample and $R^2 = 0.05$ for the validation sample). This suggests that the betas are not robust and that the model developed for the calibration sample cannot be used to confidently predict costperf in an independent sample.

In summary, our results show that performance improvements associated with Internet purchasing do occur. Furthermore, we can predict these performance improvements well by examining a series of company-specific and Internet-specific factors. The following section will examine the implications of these findings for managers of companies seeking to sell products over the Internet and from the perspective of managers seek to buy products over the internet.

7. Discussion

The explosion of e-commerce over the past 5 years has been nothing short of phenomenal, both in terms of the speed and the scope of change. There has literally been a stampede of advocates, promoters, visionaries, and true believers rushing to jump on the Internet bandwagon. However, after an initial period of turmoil and chaos, we are now experiencing a settling out or weaning period in which the wheat is being separated from the chafe, the hype separated from reality, and winners culled from the losers. This pattern of tremendous, chaotic change is typical for a revolutionary change in the business world. Yet, the historic pattern is for revolutions in thought to either quietly peter out and fade from memory or for the revolution to firmly entrench itself in the general populace and undergo a more gradual refinement. At this point, the focal point for research gradually shifts from theory building to theory testing (Glaser and Strauss 1967). The current study offers a test and refinement of Internet purchasing theories that to date have neither been well formulated or tested.

The primary factor in determining e-commerce success/failure over the next 5–10 years will be the degree to which this new tools can be seamlessly integrated into the supply chain to provide streamlined purchasing, operations, and fulfillment. This study offers three fundamental insights and refinements of existing conceptual theories. First, the assessment of two performance measures indicates that Internet purchasing generally leads to improvements. The respondents to our survey, all of which had placed orders over the Internet, generally believed that the technology led to improvements in performance, in terms of both reduced costs and improved accuracy. Thus, the data supports the general belief of Internet proponents that it can help streamline the supply chain (see Table 4).

The second set of findings addresses the more complex question of how companies should

harness the power of the Internet. Figure 1 provides a model of two sets of factors believed to influence purchasing performance. These factors were separated into purchasing company- and Internet-specific factors used to performance by means of stepwise regression. The results provide strong support for hypotheses 1–4 since almost all of the independent variables shown in Figure 1 had significant, positive correlations with the three measures of performance (see Table 6). Furthermore, the stepwise regressions demonstrate a potent relationship between the various independent variables and performance.

Managers of companies involved with Internet initiatives on the sales side can learn some lessons from this data. First, from the perspective of a company seeking to reach out to customers, the data suggest several actions that can be taken to influence the adoption and use of a sales web site. A fundamental, yet often neglected step is to make the web site simple to use and functional. Both site ease and system are highly correlated with both measures of performance. Individual items that comprise these two constructs include questions relating to system response time, ease of use, ease of navigations, and time to load the site. Actual physical delivery of products is also addressed. Other site-specific factors include accuracy—which measures the accuracy of web page content—and transact—which measures the ease of conducting specific transactions. Both of these variables also correlate highly with the performance measures. In short, the data offer a reminder to managers along the lines of the old KISS principle—Keep It Simple Stupid! The beauty of the Internet is simplicity—sure it can do amazing things with pictures, sounds, and graphics, but when conducting business, particularly with commodity products, lean and mean carries the day. While this message may sound like common sense, there is a great deal of anecdotal evidence of companies that got carried away with fancy sound and graphics and forgot to maintain basic site functionality. The other compelling message is that companies must also deliver in terms of accurate data and transactions.

The study also offers crucial insights from the customer side of Internet purchasing. The study indicates that there are definitive actions companies can take in the areas of strategy formulation, work environment, and training that can positively impact performance. First, there is a strong relationship between the setting of strategic goals and performance. For example, goals and delivery are both strongly correlated with performance. This finding implies that strategies that seek to employ the Internet to reduce cost or improve delivery in terms of order accuracy or customer service are effective. Second, both adopt level and hours per week of computer use were associated with improved performance. This suggests that it is important for companies to have a leader or champion who sets Internet policy and provides guidance for the ways in which the technology will be used. Finally, numerous Internet-specific factors were associated with improved performance, including percuse, percease, and attitude. While these factors measure general comfort levels and perceptions of the Internet, the lesson companies can take away from this is that they should work to instill a sense of confidence in their workforce. Although the beauty of the Internet is its simplicity and functionality, not all people take to it naturally like a fish in water. Thus, companies must work to train employees and provide opportunities for workers to develop skills and confidence with the technology.

The third major contribution of this study is the development of generalizable scales. Since e-commerce is a fairly new phenomenon, we have employed a combination of existing scales used for research in other areas and new scales developed specifically to measure Internet purchasing. We borrowed concepts from both the operations strategy literature and the MIS literature. The strategy scales are similar to those that have been used extensively to measure operations strategy competitive priorities, yet are modified in this study specifically for Internet applications. Similarly, the performance scales are reminiscent of measures used in the operations strategy literature, with a focus on both tactical and higher level performance. The scales that measure Internet-specific factors (percease, percuse, and attitude) are borrowed from the MIS literature and are used unchanged, except to substitute Internet purchasing

as the technology referred to rather than a specific IT software. All of these scales have been shown in this study to have good reliability and good predictive validity for Internet purchasing applications. Finally, we developed four scales that focused on site-specific features. These scales are custom-designed to measure aspects of web sites for purchasing transactions. These scales were shown to be reliable and have good predictive validity. Furthermore, these scales can be easily adapted for application to almost any web site that sells products or services over the Internet. We believe that these scales provide an important tool for future research and plan to employ these scales in a study of several other large Internet retailers.

8. Conclusion

While there has certainly been a huge amount of hype and false promises regarding the value of the Internet for business, the tools and methods underlying e-commerce have now reached a level of maturity where researchers can begin testing and refining previously fuzzy theories. We believe that this study has provided an important first step in measuring performance outcomes and factors that facilitate effective use of Internet purchasing. Future research must seek to refine these techniques and apply them to a broader sample of companies. It is important that researchers examine e-commerce from a variety of perspectives, including the technology side of developing and maintaining applications, the operations side of providing actual goods and services, and the marketing side of connecting with consumers. We view the state of e-commerce as being similar to the early production of automobiles. Like Henry Ford's high-volume Model-T production line, there have been some impressive gains in efficiency, quality, and flexibility, but there have also been some notable collapses. Just as with mass production, the Internet as a business tool offers great potential but also poses numerous challenges. To get the most out of this promising technology, there are years of refinement ahead. Researchers must seek to analyze and catalog different methods of utilizing the Internet in order to gradually expand the base of knowledge.

Appendix: Scales Used to Measure Purchasing Company Factors, Internet Factors, and Performance

*A.*1. *Purchasing Company Factors*

A.1.1. STRATEGY. How important were the following factors in the decision to use Office Depot's online ordering system? (Likert scale ranging with 1 = not important, 4 = somewhat important, and 7 = very important).

*A.*1.1.1. *Goals*

- Cost
- Convenience
- Delivery speed

*A.*1.1.2. *Admin*

- Ability to track inventory
- Reduces paperwork
- Faster access to information
- Flexibility in order size

*A.*1.1.3. *Delivery*

- Order accuracy
- Customer service of system
- Security of system

A.1.2. ENVIRONMENT. The following questions are rated on a 7-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree.

*A.*1.2.1. *Comfort*

- I am knowledgeable about personal computer usage
- I am comfortable and experienced with the Internet
- I am proficient at fixing glitches when working on the computer
- I am good at resolving problems with computers

*A.*1.2.2. *Adopt Level*

- The decision to use online ordering for materials and supplies is made by higher level managers
- The choice of which web site to use for purchasing is made by higher level managers

A.1.2.3. *Tech Support*
- There is good technical support in my company

A.2. *Internet Factors*

A.2.1. INTERNET SPECIFIC. The following questions are rated on a 7-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree.

A.2.1.1. *Percuse*
- Using Internet purchasing enables me to accomplish tasks such as order placement, order estimating and order tracking more quickly
- Using Internet purchasing improves my job performance
- Using Internet purchasing gives me greater control over my work
- Using Internet purchasing improves the quality of the work I do
- Using Internet purchasing improves my productivity
- Using Internet purchasing enhances my effectiveness on the job
- Using Internet purchasing makes it easier to do my job
- Overall, I find Internet purchasing technology useful in my job

A.2.1.2. *Percease*
- It is easy for me to remember how to perform tasks using Internet purchasing
- It is easy to get Internet purchasing to do what I want it to do
- My interaction with Internet purchasing is clear and understandable
- Overall, I believe that Internet purchasing is easy to use

A.2.1.3. *Attitude*
- I like using Internet purchasing
- Internet purchasing is fun to use
- I dislike using Internet purchasing (*R*)
- Internet purchasing provides an attractive working environment

A.2.2. SITE SPECIFIC. Please rate the following aspects of Office Depot's Internet site (from 1 = strongly disagree to 7 = strongly agree).

A.2.2.1. *Site Ease*
- I can get on the site when I want to
- The site loads quickly
- The site is easy to navigate
- The site has a logical sequence of pages
- Office Depot web site is easy to search

A.2.2.2. *Accuracy*
- Contents on the web page are current with respect to *Price*
- Contents on the web page are current with respect to *New Items*
- Contents on the web page are current with respect to *In Stock Items*
- Contents on the web page are current with respect to *Promotions*
- Office Depot has my products in stock when I place an order

A.2.2.3. *Transact*
- I experience difficulties *placing an order* when using the online ordering system (*R*)
- I experience *web page navigation* (i.e., page would not upload or server time was expired) problems when using the online ordering system (*R*)
- I experience *billing* problems when using the online ordering system (*R*)

A.2.2.4. *System*
- The online ordering system is easy to understand and use
- The system offers quick response time
- The web site offers high reliability
- The system provides a broad range of services to users
- Delivery times for Internet orders are predictable
- The Office Depot system is easy to use the first time
- If problems occur during use were they easy to resolve

Items that did not load on any Scale
- Office Depot sends order confirmation in a timely fashion
- The company delivers the items when they promised delivery
- Office Depot provides good technical support

A.3. *Performance*

A.3.1. COSTPERF
- Cost of activities associated with purchasing (*R*)
- Cost of training new personnel associated with ordering systems (*R*)

A.3.2. PERFACC
- Accuracy of your billing
- Availability of supplies and materials

NOTE: (*R*) signifies a reverse coded item.

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