Electronic Data Interchange (EDI) has come to revolutionize in recent years the way in which businesses conduct their trading activities. Based on the establishment of trading partner relationships, EDI systems have come to signify a speedy, efficient, and accurate means of electronically exchanging business transactions. Even as there is growing popularity and potential underlying EDI, there appears to be insufficient insight into the adoption and management of EDI systems. Specifically, there is a need to know more about why EDI is (or is not) adopted, how EDI has worked for past adopters, what aspects may need further development in order to enhance its value to users, and the nature of organizational experiences with EDI in general. With these factors in mind, this study reports on the results of an empirical study of EDI users. Findings indicated that organizations experience several benefits from EDI. These benefits tended to vary based on factors such as length of EDI use, proportion of customers using EDI, total EDI-related investment, and number of employees. Findings also indicated that the overall fulfillment of EDI expectations was influenced by incorporation of management reporting and the integration of EDI technology into the information systems function of the organization. The presence of formalized cost-benefit assessment procedures and planned expansion were also associated with greater fulfillment of EDI expectations. These findings are discussed in terms of their implications for the management of this valuable, strategic IT resource: EDI.

Corporate America spends billions of dollars each year on computing and business communications, with a goal of integrating hardware, software, and people into information collection, processing, and delivery structures (Scala & McGrath, 1993). Many organizations now include as part of this process the proactive use of information technology in their arsenal of strategic weapons (Van Over & Kavan, 1993). Among these “weapons” are cooperative systems for exchanging information electronically across organizational boundaries. These interorganizational systems have both processing capabilities and communications links. They enable organizations to coordinate and share information when pursuing a common objective, representing a cooperative information system that can enhance competitive advantage (Swatman & Swatman, 1992). Electronic data interchange (EDI) is a prime example of this type of system.

EDI has come to revolutionize in recent years the way in which businesses conduct their trading activities. Based on the establishment of trading partner relationships, EDI systems provide for a speedy, efficient, and accurate means of electronically exchanging business transactions. Ranging from the manner in which purchases are made to how payments are remitted, they can contribute to reducing paperwork, decreasing human error, increasing accuracy, and improving productivity. In addition, EDI systems, if adequately integrated into organizational use of information technology, can be of significant strategic value to the organization (Swatman & Swatman, 1992). To the extent that they are effectively integrated with existing information systems and resource management, EDI systems can also facilitate the reengineering of some critical business processes (Borthick & Roth, 1992; Hammer & Champy, 1993). Thus, EDI systems...
represent a resource management philosophy rather than just a technical systems issue.

Though the technology for EDI has been available for some time, its full effects are still being learned (Clinkunbroomer, 1991). Even as there is growing popularity and potential underlying EDI, there appears to be insufficient insight into the adoption and management of EDI systems. Specifically, there is a need to know more about why EDI is (or is not) adopted, how EDI has worked for past adopters, what aspects may need further development in order to enhance its value to users, and the nature of organizational experiences with EDI in general. Further study of these aspects of EDI is needed. With these factors in mind, this study reports on the results of a descriptive survey of EDI users. It adopts an empirical, hypothesis testing approach to shed light on these issues.

Background and Hypotheses

The EDI Process

EDI is the electronic, computer-to-computer exchange of business information in a structured format between business trading partners or between various units within an organization (Ferguson, Hill, & Hansen, 1990). Accordingly, EDI is a high-speed method of electronic communication that facilitates the exchange and processing of high volumes of business data from one computer to another. EDI is being used by many companies to order and pay for goods from suppliers, to arrange transportation with carriers, to receive orders from customers, to invoice customers, and to collect payments from customers. The application of EDI involves the conversion of written documents into structured, machine-readable formats so that a computer in one company or functional unit within a company can receive and process data from another company’s or unit’s computer. These documents relate to business events such as purchasing, sales, inventory management, accounts receivable, and accounts payable.

Senn (1992) notes that the following activities are key to effective EDI usage: (1) the establishment of a standard method for identifying and marking products, (2) a standard format for exchange of data, (3) EDI software, and (4) a common data dictionary. In order to run EDI, typically five basic components are needed (Colberg, 1990): (1) a body of EDI standards such as those developed by the American National Standards Institute (ANSI), (2) EDI software to generate, receive, and interpret transactions with trading partners, (3) a capability to send and receive EDI transactions, a function often provided by value-added networks (VAN), or by third-party networks or point-to-point configurations, (4) enhancements to applications software required to accept or originate EDI transactions, and changes to traditional business procedures for strategic advantage, and (5) hardware, including appropriate peripherals such as a printer, modem, and storage devices.

As illustrated in Figure 1 (Ferguson, Hill, & Hansen, 1990), the differences between traditional, paper-based systems (Panel A) and EDI systems (Panel B) can be significant. The time delays (denoted by bent lines in Panel A) associated with each stage of a business transaction in paper-based systems do not present the same concerns in EDI systems (denoted by straight lines in Panel B). For example, the time delays between order inquiry and inquiry response, placing a purchase order and receiving it, sending an invoice and receiving it, mailing a payment and receiving it, and updating accounts is reduced, if not eliminated, by means of electronic exchanges of underlying information in an EDI system.

Transmitting messages in EDI systems involves several stages. To illustrate a specific EDI communication, consider a purchasing/selling transaction between a buyer and seller. First, a buyer initiates the EDI transaction. The buyer’s computer system translates, for example, a purchase order into the required EDI format (transaction set). During this phase, the buyer must also provide the system with information on the seller’s name and identification number. Next, the buyer’s system inserts identification information in front of the transaction set and control totals after the transaction set. Then, the buyer transmits the EDI envelope to the seller.

Once the seller receives this information, he/she verifies the format of, and control totals in, the transaction set, ensuring that all information contained in the envelope was received clear, ungarbled, and intact. The seller then sends a functional acknowledgment to the buyer. The functional acknowledgment does not confirm that the seller intends to supply goods to the buyer, but that the information was received. At this time, the seller translates the transaction set into his/her own internal processing format and processes the transaction. When the buyer receives the goods, he/she sends a receiving advice to the seller. The seller responds by sending a remittance advice to the buyer who pays the supplier with an electronic fund transfer. At each stage of the process, when information is transferred, the receiver responds with a functional acknowledgment.

Potential Merits of EDI

EDI can present an adopting organization with many advantages as well disadvantages (Scala & McGrath, 1993). First, the time needed to exchange information is greatly reduced (Muller, 1994). Paper-based systems are often inordinately slow. However, the time for mailing and processing (e.g., keying and rekeying order information) inherent in paper systems is eliminated with EDI. EDI messages can replace any paper document exchanged between two parties when completing a transaction. Moreover, the computer exchange of information is instantaneous. This can streamline interactions and improve the quality of customer service.

Secondly, EDI systems can contribute to reduced clerical error (Smith, Strawser, & Wiggins, 1991). With EDI
Figure 1: Paper vs. EDI Transactions Timeline
systems, personnel do not need to rekey information contained in paper documents into the paper system. Less rekeying translates into fewer errors, greater accuracy and faster response times. EDI also eliminates the need for personnel to reconcile purchase orders, receiving reports, remittance advices, bills of lading, etc. Thus, EDI can also improve control over data and enhance the quality and consistency of transaction processing.

Thirdly, EDI can contribute to reduced administrative costs (Solis, 1993; Stamper, 1991). Paper-based systems are more labor intensive than EDI systems. In EDI systems, since paper documents can be replaced with electronic messages, administrative paperwork and clerical processing activities are greatly reduced. Therefore, labor can be used more efficiently and productively. Reducing clerical activities can also translate into a reduction in labor costs. In addition, since messages are sent electronically, EDI can streamline the order/delivery cycle, further reducing the mailing and ordering costs included in overhead.

Fourthly, as paper-based systems are slow and order lead times are higher, companies without EDI systems may need to maintain higher inventory levels (Sadhwani & Sarhan, 1987). In contrast, since companies using EDI systems can exchange information instantaneously, order lead times may be reduced. As a result, companies may not have to carry as much excess inventory to guard against stockouts, lowering inventory carrying costs. Fewer out-of-stock situations may also mean fewer lost sales and opportunity costs. With EDI, orders can also be processed faster, allowing firms to significantly reduce inventory levels and to order materials as they are needed. Furthermore, the computer-to-computer communication with suppliers provides managerial personnel with the opportunity to scan the computers of suppliers and to look for the lowest bids and the highest quality. These factors can contribute to increased sales.

Hypotheses

The benefits discussed above are dependent, however, on several other factors. Prior research has not empirically examined these factors, but suggests that length of EDI use (Rouland, 1991), proportion of customers using EDI (Solis, 1993; Waller, 1991), and IS resources devoted to this function (O’Callaghan, Kaufmann, & Konsynski, 1992) such as total EDI-related investment and number of employees in the IS area can affect the extent to which EDI benefits are realized. This is because EDI use cannot yield benefits overnight; rather, a more valid presumption may be that the greater the length of time the organization has had to use and integrate EDI technology and to develop a sufficiently robust EDI customer base, the greater will be the contribution of EDI technology. Additionally, the greater the IS resources that have been devoted to EDI (e.g., EDI-related information technology investment and employees), the greater the likelihood that benefits have been predicted to materialize. These factors, in conjunction with the benefits discussed earlier, can also be expected to determine the extent to which an organization’s EDI expectations are fulfilled. This suggests the following hypothesis: the benefits obtained from EDI will be positively influenced by length of EDI use, proportion of customers using EDI, total EDI-related investment, and number of employees. This hypothesis will be evaluated with reference to each of five dimensions of EDI benefits and the fulfillment of EDI expectations, and may, therefore, be restated as follows.

H1: Length of EDI use has a significant positive influence on: (a) improved customer service, (b) reduced clerical error, (c) improved control of data, (d) decreased administrative cost, (e) increased sales, and (f) the extent to which EDI fulfills an adopting organization’s expectations.

H2: Proportion of customers using EDI has a significant positive influence on: (a) improved customer service, (b) reduced clerical error, (c) improved control of data, (d) decreased administrative cost, (e) increased sales, and (f) the extent to which EDI fulfills an adopting organization’s expectations.

H3: Total EDI-related investment has a significant positive influence on: (a) improved customer service, (b) reduced clerical error, (c) improved control of data, (d) decreased administrative cost, (e) increased sales, and (f) the extent to which EDI fulfills an adopting organization’s expectations.

H4: Number of employees has a significant positive influence on: (a) improved customer service, (b) reduced clerical error, (c) improved control of data, (d) decreased administrative cost, (e) increased sales, and (f) the extent to which EDI fulfills an adopting organization’s expectations.

EDI, in conjunction with automated parts recognition and tracking systems, can provide managerial personnel with up-to-date inventory data and raw material status reports from distributed locations (Sadhwani & Sarhan, 1987). Production managers can plan production schedules more effectively, improving materials and inventory management. An advance shipment notice can be used to notify customers that the goods they requested are being delivered and can serve as a request for payment, triggering their accounts payable to send the amount owed. This way, firms can also have more accurate and timely information regarding cash receipts from customers and can manage their cash balances more effectively. Thus, EDI systems when strategically integrated with materials, inventory, fixed asset, and cash management functions and associated management reporting, can become a valuable
organizational IT resource (Kiely, 1990; McCusker, 1994; Swatman & Swatman, 1992) and can contribute more directly to organizational fulfillment of EDI expectations. This suggests the following hypothesis.

**H5:** The extent to which EDI fulfills an adopting organization’s expectations is influenced by: (a) incorporation of management reporting, and (b) strategic EDI integration.

**Method**

To test the hypotheses proposed in this study and to gain deeper insights into EDI, a survey was mailed to 900 organizations, all registered EDI users. These users were selected from a confidential database provided to the author by Phillips Business Information, Inc., publisher of the 1994 EDI Yellow Pages. The surveys were addressed to the EDI coordinators within the respondent organizations. The survey contained five sections. The first section asked for several details regarding the organization’s background, specifically number of employees, annual revenues, principal line of business, and number of stores/outlets. The second section asked about the organization’s perceived barriers to EDI adoption. A list of barriers was provided and respondents could check the items that applied (please see Table 4).

The third section sought to ascertain the reasons for EDI adoption within the respondent organization. A list of reasons was provided and the respondent could check those that applied (please see Table 5). Questions about the initiation of EDI use, pre-implementation justification analysis, and investment in EDI were also contained in this section. The fourth section elicited ratings of benefits actually obtained from EDI use, along with some information regarding customer/supplier use of EDI. Specifically, respondents were asked to rate several provided items (please see Table 6) on a 10-point scale in terms of benefits that their organization had actually obtained from EDI use. Questions on the extent of management reporting, integration with strategic planning, and proportion of customers and suppliers using EDI were also included in this section. The last section asked respondents about the extent to which the benefits from EDI had met their initial expectations (please see Table 6). Questions on post-implementation justification analysis and anticipated expansion in EDI use were also included in this section.

**Results**

**Respondent Profiles**

A total of 180 responses was obtained. This represented a 20% response rate. As shown in Table 1, approximately half of all respondents were from the manufacturing industry (which was consistent with the original sample, where 45.4% were from the manufacturing industry). Respondents were also from wholesale (21.11%) and retail trade (6.11%), as well as transportation, communications, electric, gas, and sanitary services (12.78%). In order to see if responding firms had significantly different characteristics among each other, a comparative analysis of industry membership and revenues was conducted. No significant differences were evidenced, supporting the potential generalizability of this study’s results.

The respondents were from a broad range of industries and organizations. The average number of employees in the responding organizations was 7,442 (see Table 2), with a range of 3 to 600,000. The average annual revenues were $907 million. Organizations had an average of 313 outlets each. A majority of responding organizations were fairly recent EDI adopters. More than half of them (57.5%, to be precise) adopted EDI between 1990 and 1994. The remainder adopted EDI between 1985-89 (25.6%) or before 1985 (16.9%). The proportion of respondents’ customers and suppliers using EDI was 33.1% and 26.1% respectively. The mean investment in EDI was as follows: software $32,412, hardware $54,129, and training & support $73,755. The correlation between organi-
zation size (as proxied by annual revenues) and EDI-related investment was .3609 ($p = .004$). Respondent profiles are summarized in Table 2.

**EDI Adoption Information**

As shown in Table 3, a majority of responding organizations had not prepared a formal justification analysis before EDI adoption (71.9%) or after EDI adoption (83.8%). A significant majority of the respondents (85.1%) also answered yes to the question of whether they envisioned an expansion of EDI use in their organizations; only 9.4% answered no, while 5.5% were not sure.

The most frequently cited barrier to EDI adoption was that of lack of awareness of EDI benefits. Of all respondents, 37.9% indicated that this was a barrier. Very close to this was the presence of a non-automated/non-sophisticated customer or supplier (36.3%). High cost/Setup cost was also frequently cited as a barrier (30.2%). Customer or supplier training & education and acceptance were also cited as barriers by 26.4% and 23.1% respectively of all respondents. The lack of standard formats (20.9%) and compatibility of hardware and software (19.8%) received some attention. About 16% of all respondents indicated that a lack of trading partners was a barrier. Only 9.9% said that there were no barriers to EDI adoption. These frequencies are provided in Table 4.

A significant majority of respondents (127 citations or 79.4%) indicated that customer’s request was instrumental in their EDI adoption (see Table 5). This is consistent with the notion that many businesses frequently adopt EDI just in order to keep a large customer who happens to be a steady EDI user. For example, as Kiely (1990) notes, Chrysler and Sears Roebuck both have EDI as a requirement for doing business with them and both help their suppliers with the transition. A majority of respondents (51.3%) also cited the need to remain competitive as a reason for adopting EDI. Better customer service (48.1%), speed up/reduce paperwork (47.5%), and improve accuracy (42.5%) were also cited by significant proportions of the respondents as reasons for adopting EDI. Other important reasons for EDI adoption cited by the respondents included: cost efficiency (32.5%), ease of processing for order entry (30.6%), increase productivity (26.3%), and quick response and access to information (23.8%). Some of the remaining reasons cited were: reduce manpower (19.4%), aid accounting/billing (18.8%), better communications (18.8%), supplier’s request (16.3%), convenience (15%), industry standards (12.5%), and inventory control/reduction (10.6%). A basic appeal of EDI is that it enables a wide range of business transactions to be conducted electronically in split seconds. As Clinkunbroomer (1991) notes, with 85% of R.J. Reynolds’s purchase orders using the technology, EDI has cut 21 days off delivery time on orders from European suppliers; in accounts payable, AT&T estimates that EDI has resulted in a 50% reduction of the internal cost of processing the firm’s invoices.

**Table 3: EDI Adoption Detail**

<table>
<thead>
<tr>
<th>Perceived Barrier</th>
<th>Number of Respondents</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of awareness of EDI benefits</td>
<td>69</td>
<td>37.9%</td>
</tr>
<tr>
<td>Non-automated / Non-sophisticated customer or supplier</td>
<td>66</td>
<td>36.3%</td>
</tr>
<tr>
<td>High cost / Setup cost</td>
<td>55</td>
<td>36.2%</td>
</tr>
<tr>
<td>Customer or supplier training &amp; education</td>
<td>48</td>
<td>26.4%</td>
</tr>
<tr>
<td>Customer or supplier acceptance</td>
<td>42</td>
<td>22.1%</td>
</tr>
<tr>
<td>Lack of standard formats</td>
<td>38</td>
<td>20.9%</td>
</tr>
<tr>
<td>Compatibility of hardware / software</td>
<td>36</td>
<td>19.8%</td>
</tr>
<tr>
<td>Lack of trading partners</td>
<td>29</td>
<td>15.9%</td>
</tr>
<tr>
<td>No significant barriers to EDI adoption</td>
<td>19</td>
<td>9.9%</td>
</tr>
<tr>
<td>Other barriers</td>
<td>34</td>
<td>18.7%</td>
</tr>
</tbody>
</table>

**Table 4: Perceived Barriers to EDI Adoption**

**Table 5: Reasons for EDI adoption**

<table>
<thead>
<tr>
<th>Adoption Reason</th>
<th>Number of Citations</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer’s request</td>
<td>127</td>
<td>79.4%</td>
</tr>
<tr>
<td>Remain competitive</td>
<td>82</td>
<td>51.3%</td>
</tr>
<tr>
<td>Better customer service</td>
<td>77</td>
<td>48.1%</td>
</tr>
<tr>
<td>Speed up / Reduce paperwork</td>
<td>76</td>
<td>47.5%</td>
</tr>
<tr>
<td>Accuracy</td>
<td>68</td>
<td>42.5%</td>
</tr>
<tr>
<td>Cost efficiency</td>
<td>52</td>
<td>32.5%</td>
</tr>
<tr>
<td>Ease of processing for order entry</td>
<td>49</td>
<td>30.6%</td>
</tr>
<tr>
<td>Increase productivity</td>
<td>42</td>
<td>26.3%</td>
</tr>
<tr>
<td>Quick response and access to info</td>
<td>38</td>
<td>23.8%</td>
</tr>
<tr>
<td>Reduce manpower</td>
<td>31</td>
<td>19.4%</td>
</tr>
<tr>
<td>Aids in accounting / billing</td>
<td>30</td>
<td>18.8%</td>
</tr>
<tr>
<td>Better communications</td>
<td>30</td>
<td>18.8%</td>
</tr>
<tr>
<td>Supplier’s request</td>
<td>26</td>
<td>16.3%</td>
</tr>
<tr>
<td>Convenience</td>
<td>24</td>
<td>15.0%</td>
</tr>
<tr>
<td>Industry standards</td>
<td>20</td>
<td>12.5%</td>
</tr>
<tr>
<td>Inventory control / reduction</td>
<td>17</td>
<td>10.6%</td>
</tr>
<tr>
<td>Tracing shipments</td>
<td>13</td>
<td>8.1%</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>4.4%</td>
</tr>
</tbody>
</table>
Ratings revealed that “Improved customer service” received the highest rating among the factors rated as benefits actually realized from EDI. On a scale of 1 (lowest) to 10 (highest), improved customer service received a mean rating of 7.71. This was followed by reduced clerical error (6.35), improved control of data (5.69), and increased sales (5.57). Factors such as decreased administrative cost, inventory cost, and manufacturing cost seemed to figure less prominently as benefits. The survey also contained an overall question about the extent to which benefits from EDI had met initial expectations. The mean rating on a scale of 1 (lowest) to 11 (highest) was 5.61, indicative perhaps of the room for improvement in the design, implementation, and use of EDI systems. The ratings are summarized in Table 6.

**Hypotheses Tests**

In order to test the four hypotheses, each of the five primary dimensions of EDI benefits (improved customer service, reduced clerical error, improved control of data, decreased administrative cost, and increased sales) was analyzed in a multiple regression model with length of EDI use, proportion of customers using EDI, total EDI-related investment, and number of employees as independent variables.

In strong support of Hypothesis 1a, 1d, 1e, and 1f, length of EDI use had a significant influence on improved customer service ($t = 2.553; p = .0119$), decreased administrative cost ($t = 3.169; p = .0020$), increased sales ($t = 2.164; p = .0328$), and fulfillment of EDI expectations ($t = 3.787; p = .0002$) respectively. The hypothesized links of length of EDI use with reduced clerical error (Hypothesis 1b) and improved control of data (Hypothesis 1c) were not significant.

In significant support of Hypothesis 2a and 2c, the proportion of customers using EDI was significantly related to improved customer service ($t = 3.581; p = .0005$) and decreased administrative cost ($t = 2.164; p = .0327$) respectively, but not with reduced clerical error (Hypothesis 2b), improved control of data (Hypothesis 2d), increased sales (Hypothesis 2e), or fulfillment of EDI expectations (Hypothesis 2f). While total EDI-related investment was not significantly associated with improved customer service (Hypothesis 3a), reduced clerical error (Hypothesis 3b), improved control of data (Hypothesis 3c), increased sales (Hypothesis 3e), or fulfillment of EDI expectations (Hypothesis 3f), it did have a significant influence on decreased administrative cost ($t = 2.643; p = .0107$), thus providing strong support for Hypothesis 3d.

Hypothesis 4a and 4d were strongly supported as number of employees was significantly associated with improved customer service ($t = 1.996; p = .0481$) and decreased administrative cost ($t = 2.164; p = .0327$) respectively, but not with reduced clerical error (Hypothesis 4b), improved control of data (Hypothesis 4c), increased sales (Hypothesis 4e), or fulfillment of EDI expectations (Hypothesis 4f). These results are presented in Tables 7 and 8.

In strong support of both Hypothesis 5a and 5b, the fulfillment of EDI expectations was strongly impacted by the incorporation of management reporting ($F = 14.23; p = .0002$) and strategic integration of EDI technology ($F = 20.12; p = .0001$). This is shown in Table 9. In order to provide

### Table 6: Rating of Benefits Actually Realized from EDI

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Average Rating *</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved customer service</td>
<td>7.71</td>
<td>9.00</td>
<td></td>
</tr>
<tr>
<td>Reduced clerical error</td>
<td>6.35</td>
<td>7.00</td>
<td></td>
</tr>
<tr>
<td>Improved control of data</td>
<td>5.69</td>
<td>6.00</td>
<td></td>
</tr>
<tr>
<td>Increased sales</td>
<td>5.57</td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td>Decreased administrative cost</td>
<td>5.06</td>
<td>5.00</td>
<td></td>
</tr>
</tbody>
</table>

*NOTE: 1=lowest, 10=highest

Table 7: Regressions with User Rating of EDI Benefit as Dependent Variable

- **Length of EDI use (in yrs):**
  - Improved customer service: $0.2226(460; 3.53); p = .0119$
  - Reduced clerical error: $0.1378(974; 1.49); p = .1365$
  - Improved control of data: $0.1124(330; 1.17); p = .2445$
  - Decreased administrative cost: $0.2928(723; 3.16); p = .0020$
  - Increased sales: $0.2113(503; 2.16); p = .0328$

- **% of Customers using EDI:**
  - Improved customer service: $0.1672(394; 3.81); p = .0005$
  - Reduced clerical error: $0.1765(940; 1.51); p = .1320$
  - Improved control of data: $0.1541(369; 3.44); p = .0008$
  - Increased sales: $0.1967(990; 2.02); p = .0481$
  - Decreased administrative cost: $0.0712(457; 0.52); p = .5934$

- **Total EDI-related investment ($1m):**
  - Improved customer service: $0.1155(707; 0.91); p = .5016$
  - Reduced clerical error: $0.1671(730; 1.30); p = .1997$
  - Improved control of data: $0.1153(840; 0.80); p = .3923$
  - Increased sales: $0.3507(240; 2.64); p = .0107$
  - Decreased administrative cost: $0.1984(959; 1.17); p = .2437$

- **Number of Employees (1000):**
  - Improved customer service: $0.1750(930; 1.99); p = .0481$
  - Reduced clerical error: $0.0564(122; 0.61); p = .5401$
  - Improved control of data: $0.1063(371; 1.10); p = .2710$
  - Increased sales: $0.2066(936; 1.04); p = .3277$
  - Decreased administrative cost: $0.1207(305; 1.24); p = .2178$

In strong support of both Hypothesis 5a and 5b, the fulfillment of EDI expectations was strongly impacted by the incorporation of management reporting ($F = 14.23; p = .0002$) and strategic integration of EDI technology ($F = 20.12; p = .0001$). This is shown in Table 9. In order to provide
supplementary insights, the fulfillment of EDI expectations was also analyzed using three one-way analysis of variance (ANOVA) models with pre- and post-implementation justification analyses and planned expansion coded as being either present or absent. Results showed that those EDI adopters who adopted formalized justification analysis and/or planned EDI expansions had higher fulfillment ratings than those who did not (justification analysis: F=6.49; p=.0119; planned expansion: F=22.17; p=.0001). The link between fulfillment of EDI expectations and pre-implementation justification analysis was significant at the \( p=.0803 \) level.

### Summary and Conclusions

This study has examined contemporary use and management of an increasingly important organizational resource: EDI. Results indicated that organizations experience several benefits from EDI. These benefits tended to vary based on factors such as length of EDI use, proportion of customers using EDI, total EDI-related investment, and number of employees. Specifically, length of EDI use was related to improved customer service, decreased administrative cost, increased sales, and overall fulfillment of EDI expectations. The proportion of customers using EDI was related to improved customer service and improved control of data. Both total EDI-related investment and number of employees were associated with decreased administrative cost, while number of employees was also associated with improved customer service. Findings also indicated that the overall fulfillment of EDI expectations was influenced by the incorporation of management reporting and the strategic integration of EDI technology into the IS function of the organization. The presence of formalized cost-benefit assessment procedures and planned expansion were also associated with greater fulfillment of EDI expectations.

These findings suggest that EDI adoption and successful use are relatively complex, multidimensional issues. More specifically, benefits from EDI adoption are not likely to be immediate. Rather, they may be a function of factors such as length of EDI use, proportion of EDI customers, and total EDI-related investment which contribute to the growth, acceptance, and integration of EDI technology into the IS function of the organization. However, as several EDI users suggest, these factors may need to be reconciled with the possibility that an organization’s number of trading partners may be limited. They are nevertheless faced with the need to use EDI at the request of a few important customers rather than a sufficiently robust base of EDI partners. Some companies may also find that customers or suppliers may not be willing or sophisticated enough to adopt EDI.

Analyses of survey responses also suggest that while significant developments have taken place in the adoption of EDI technology, the potential of EDI may not have been fully realized. The establishment of mutually beneficial trading relationships and customer service appear to be clearly important considerations in EDI adoption, as do the need to reduce paperwork, improve accuracy, and remain competitive (Ali, 1992; Arunachalam, 1995). However, many organizations did not rate factors such as inventory control or cost reduction as highly as might be expected. A barrier may be a lack of awareness of EDI benefits, compounded by high setup costs and insufficient customer/supplier automation, training, and acceptance (Andel, 1991; Arunachalam, 1995). The reporting features available to EDI users, quality of documentation, and user training available within EDI systems may also be areas for further improvement. Last, but not the least, the level of EDI integration is an important consideration in assessing the extent to which EDI’s potential has not been realized.

Teschler (1991) discusses four types of EDI integration: (1) door-to-door, (2) application level, (3) functional level, and (4) enterprise level. At the level of door-to-door EDI integration, the business objective is primarily that of reacting to large trading partners, with the primary business benefits of

### Tables

**Table 8: Regressions with Fulfillment of EDI Expectations as Dependent Variable**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Standardized Parameter Estimate</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of EDI use (yrs)</td>
<td>0.294 (26870)</td>
<td>3.787</td>
<td>.0002</td>
</tr>
<tr>
<td>% of customers using EDI</td>
<td>0.159 (97041)</td>
<td>1.735</td>
<td>.0818</td>
</tr>
<tr>
<td>Total EDI-related investment ($m)</td>
<td>0.071 (72519)</td>
<td>0.610</td>
<td>.5437</td>
</tr>
<tr>
<td>Number of employees (1000)</td>
<td>0.062 (4634)</td>
<td>0.764</td>
<td>.459</td>
</tr>
</tbody>
</table>

**Table 9: ANOVA with Fulfillment of EDI Expectations as Dependent Variable**

<table>
<thead>
<tr>
<th>Factor</th>
<th>df</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Reporting</td>
<td>(L.141)</td>
<td>14.23</td>
<td>.0002</td>
</tr>
<tr>
<td>Strategic EDI Integration</td>
<td>(L.129)</td>
<td>26.12</td>
<td>.0001</td>
</tr>
<tr>
<td>Planned Expansion</td>
<td>(L.148)</td>
<td>22.17</td>
<td>.0001</td>
</tr>
<tr>
<td>Pre-implementation justification analysis</td>
<td>(L.145)</td>
<td>3.10</td>
<td>.0803</td>
</tr>
<tr>
<td>Post-implementation justification analysis</td>
<td>(L.149)</td>
<td>6.49</td>
<td>.0119</td>
</tr>
</tbody>
</table>
speed and business necessity. At the application level of EDI integration, the business objective is characterized as that of clerical streamlining, and has the primary benefits to the business of error reduction and elimination of rekeying data. At the functional level of EDI integration, the objective is that of functional process streamlining, which is beneficial in terms of work simplification, organizational effectiveness, and lowered costs through mutual trading partner benefits. At the enterprise level of EDI integration, the objective is to develop an infrastructure that supports any or all trading partners; the benefits are perceived to be related to changes in business practices to gain competitive advantage and enterprise efficiencies.

While the use of EDI can enhance both local and international commerce, the full perspective of the business change associated with any type of EDI integration must not be overlooked. Therefore, management must be willing to adjust fundamental activities to participate successfully. Resistance, if any, to EDI could be due to the very fact that successful EDI programs may well require a complete rethinking of organizational structures and procedures. However, if management can address this by highlighting the significant benefits attached to EDI, then associated change management can become an integral part of EDI adoption and use. As Ali (1992) points out, there are significant strategic benefits to EDI, including competitive advantage, speeding up information flow, optimizing productivity, locking in customers, utilizing trends, and marketing electronically.

These benefits are dependent, however, on the degree to which EDI systems are integrated into the organization’s existing information systems. One line of reasoning is as follows. Within the information processing paradigm of organizational design (Daft & Lengel, 1986; Galbraith, 1973), information technology (IT) represents a response to the requirements for organizational coordination and control (OCC). On the other hand, internal task interdependencies among organizational units and the degree of formalization in organizational structure represent sources of coordination requirements for the sharing of scarce resources (Govindarajan & Fisher, 1990).

However, this is an intra-organizational perspective of the contingencies relevant to information systems effectiveness (Gordon & Miller, 1976). The introduction of information sharing systems that cross organizational boundaries significantly increases the degree of complexity in the operating environment of organizational information systems and necessitates changes in their design in order to integrate inter-organization information (Bakos, 1991; Barrett & Konsynski, 1982). To the extent that inter-organization dependencies add to internal organizational requirements for coordination and control, EDI effectiveness also relies significantly on inter-organizational sources of OCC.

Therefore, in considering the overall cost-benefit equa-

**References**


McCusker, T. (1994). How to get more value from EDI.
Datamation, 40(9), May 1, 1994, 56-60.

Dr. Vairam Arunachalam is an Assistant Professor of Accounting at the University of Missouri - Columbia. He received his Ph.D. in Accounting from the University of Illinois, Urbana-Champaign, in 1991. His research interests include the assessment of information technology impacts, software reengineering, group decision and negotiation, and behavioral issues in information systems design and use. He has published in several journals including: Organizational Behavior and Human Decision Processes; Journal of Information Systems; Advances in Accounting Information Systems; Accounting, Management and Information Technologies; Journal of Systems and Software; Journal of Systems Management; Advances in Management Accounting; Group Decision and Negotiation; Issues in Accounting Education; The Accounting Educators’ Journal; Journal of International Accounting, Auditing & Taxation; Accountants’ Journal; CA Magazine; Chartered Accountant; and Georgia Journal of Accounting.
Related Content

Service Failure and Recovery in Electronic Retailing: An Investigation of Product-Oriented and Service-Oriented Transactions
[www.irma-international.org/article/service-failure-recovery-electronic-retailing/1362/](http://www.irma-international.org/article/service-failure-recovery-electronic-retailing/1362/)

Perceptions, User Satisfaction and Success: Testing the DeLone and McLean Model in the User Developed Application Domain
[www.irma-international.org/chapter/perceptions-user-satisfaction-success/4614/](http://www.irma-international.org/chapter/perceptions-user-satisfaction-success/4614/)

Positioning in Cyberspace: Evaluating Telecom Web Sites Using Correspondence Analysis
[www.irma-international.org/article/positioning-cyberspace-evaluating-telecom-web/1193/](http://www.irma-international.org/article/positioning-cyberspace-evaluating-telecom-web/1193/)

Challenges in the Adoption of Information Technology at Sunrise Industries: The Case of an Indian Firm
[www.irma-international.org/chapter/challenges-adoption-information-technology-sunrise/44592/](http://www.irma-international.org/chapter/challenges-adoption-information-technology-sunrise/44592/)

An Embedded Approach for Project Management Learning Process
[www.irma-international.org/article/an-embedded-approach-for-project-management-learning-process/80404/](http://www.irma-international.org/article/an-embedded-approach-for-project-management-learning-process/80404/)