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## **Whither EDI? An Analysis of Emerging Trends in Electronic Data Interchange (EDI) Use in Small-to Medium-Sized Enterprises in Kentucky**

Deepak Khazanchi\*

In this era of Internet Commerce, Electronic Data Interchange (EDI) continues to be an important technology for small- to medium-sized enterprises (SMEs). For new adopters, it has never been more important to understand the nature of EDI use in the current business environment and the possibilities for the future. Based on a research study conducted on the experience of SMEs in the Commonwealth of Kentucky, this article describes some key survey findings that are potential indicators of emerging trends in the use of EDI within small firms. Included in the following discussion are answers to the following questions. Why do SMEs adopt EDI? What kind of support do they get from larger trading partners? What benefits have SMEs obtained from this technology so far? How many trading partners will be added? What types of EDI transactions will be added? What has been the growth in document volume for SMEs? What is the future potential? What kinds of alternative to traditional EDI are being considered? Are SMEs using (or plan on using) EDI for international trade?

### **I. Electronic Data Interchange**

Electronic Data Interchange (EDI) is the computer-to-computer interchange of business transactions that conforms to specified standards over a communications network that includes at least two *trading partners*. These interactions include the interchange of common commercial information typically consisting of purchase orders, shipping notices, invoices, related acknowledgements, funds transfer with banks, etc. EDI automates the slow, labor-intensive exchanging of transactional documents in paper form via fax and/or regular mail. The EDI enterprise is the **hub** of activities. Hubs represent the accumulation point for transactions from multiple trading partners. For example, Wal-Mart is a

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hub with more than 5000 electronic hook ups with its vendors. The **trading partners** can be viewed as **spokes**. Spokes (vendors, customers, etc.) become part of the extended EDI enterprise. Larger spokes can be hubs of their own supplier, customer networks. Most SME's tend to be spokes for large hub organizations.

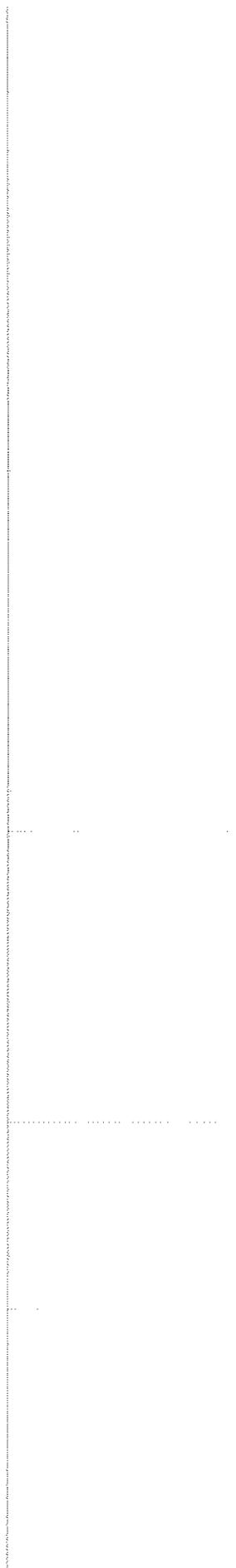
EDI requires five key elements:

- Electronic mail for rapid personal (administrative) communications,
- On-line networks for rapid communications such as third party or value added networks (VANS),
- At least two organisations conducting joint business transactions electronically (trading partners),
- Standard protocols for file and message transfers. This is accomplished with trading partner agreements regarding data coding and formatting rules. Standard EDI message formats can be those developed by industrial organisations (e.g., TDCC/EDIA, VICS, WINS), proprietary (e.g., General Motors), national (ANSI X12) or International (UN/EDIFACT), and
- Data processing task(s) at both (all) organisations pertaining to a transaction are supported by independent application systems.

There are three generic approaches to implementing EDI links:

- Direct EDI link between vendor and customer using a modem and telephone line. Many large hub organisations own and operate a private network service (e.g., Wal-Mart) that all business partners are required to use. Trading partners establish communications using a dial-up link to the hub's network. While a majority of these hubs do not charge for their network service, trading partners do have to pay all phone charges.
- Indirect EDI links through value-added networks (VAN) or "third party electronic clearing houses." These independent EDI networking vendors provide all the necessary software and communications services and essentially perform the function of an electronic post office for numerous business partners. Trading partners place their business documents in "electronic envelopes" identifying the sender and receiver. The document is mailed to the VAN after setting up a dial-up link via phone lines. The VAN will either forward the document to the hub organisation's computer automatically or place it in the receiver's mailbox for pickup at a later time. Major costs associated with this EDI transmission option will include expenses relating to VAN setup, telephone lines, and monthly transaction fees.

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- With the development of better Internet browsers and compatible EDI software that incorporates adequate security measures including strong encryption, the robust and cheaper Internet will fast become the medium of choice for transmitting electronic documents and messages. This approach is essentially similar to the direct communications link except that the Internet access charges are substantially lower than the other options.

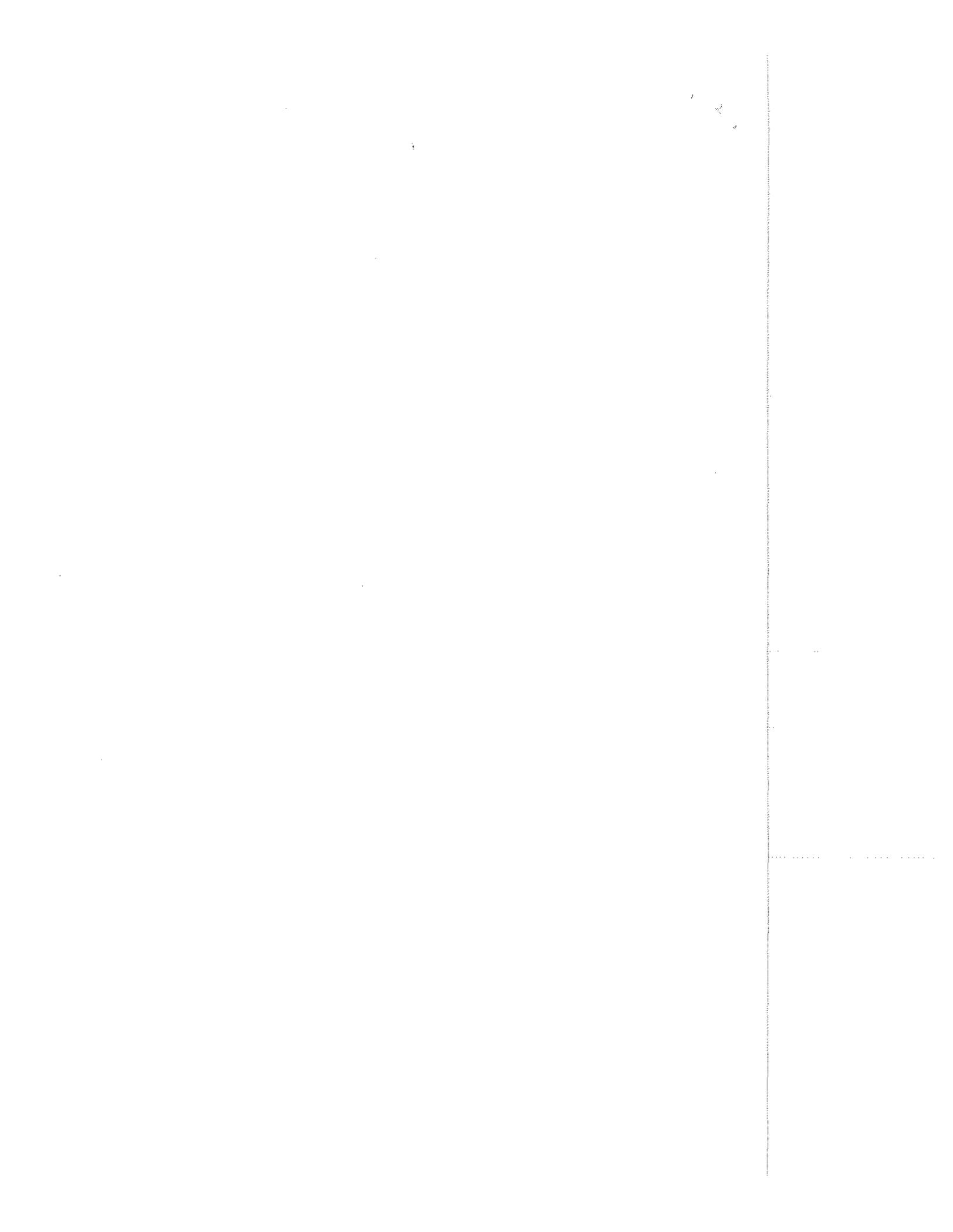
## II. Research Method

The results reported in this article are based on a larger research study conducted in fall of 1997 and spring 1998 on the "organizational impact of Electronic Data Interchange (EDI) in small- to medium enterprises (SMEs)." This study utilized a survey to elicit responses from 353 EDI-capable small-to medium sized businesses located in the Commonwealth of Kentucky were identified from the *1997 EDI Yellow Pages* (Phillips Business Information, Inc., 1997) and through direct contact with local EDI organizations and EDI hubs in the region. Nearly 24.3% (86 responses) of the surveyed-organizations responded with companies from the manufacturing (57%) and wholesale trade (27%) sector making up nearly 84% of the sample. A large number (nearly 70%) of responding firms had gross sales over \$1 million in 1997 with more than half (47%) generating over \$10 million in sales. Nearly a dozen firms (14%) did not reveal their sales numbers. The remaining firms were evenly split between \$10,000 and \$1 million in gross sales.

## III. Survey Findings

### A. Why do SMEs Implement EDI?

In order to understand the nature of the EDI adoption decision in Kentucky SMEs, respondents were asked to rate the degree to which various criteria influence their decision making processes. Respondents were asked to choose from an interval scale that varied from a "1" or "no influence at all" to 4 "major influence." Table 1 (refer Appendix) presents the descriptive statistics of the responses to this question. As expected, the most influential reason for the adoption of EDI by surveyed-organizations is "customer or supplier's demand." Its mean "influence" rating of 3.95 is significantly more than the scores for all other EDI adoption decision



variables. This is followed by decision factors that range from “forges stronger business relationships with partners” (2.95) to “decreases transaction costs” (2.02). The mean “importance” scores for these factors indicate that they have a moderate to minor influence on the EDI adoption decision. Surprisingly, economic factors such as “reduces number of employees” (1.35) and “decreases inventory & carrying costs” (1.49) had very little influence on the EDI adoption decision.

**TABLE 1: EDI DECISION CRITERIA (DESCRIPTIVE STATISTICS)**

<b>EDI Decision Criterion:</b>	<b>N</b>	<b>Mean</b>
Customer or Supplier's Demand	82	3.83
Forges strong business relationships with partners	81	2.95
Improves communication with trading partners	81	2.89
Remain competitive	82	2.70
Improves accuracy of information	82	2.68
Improves customer service	82	2.59
Quicker response and access to information	81	2.51
Meeting industry standards	82	2.44
Improves ability to control & coordinate data	81	2.30
Reduces paperwork	82	2.22
Ease of processing for order entry	82	2.18
Pressure from competitors	81	2.10
Increases sales revenues/Increases Profits	81	2.10
Decreases transaction costs	81	2.02
Aids in accounting, billing, production scheduling	81	1.99
Decreases administrative costs	81	1.95
Improves efficiency of business operations	81	1.94
Ease of tracking shipments/Ease of tracking Orders	81	1.81
Makes Just-In-Time manufacturing possible	81	1.74
Decreases procurement costs	81	1.60
Decreases manufacturing costs	80	1.58
Reduces inventory & carrying costs	81	1.49
Reduces number of employees	80	1.35

Apparently, the above results confirm the notion that EDI adoption in small- to medium-sized enterprises is not altogether “voluntary.” Most firms purchase EDI to keep their major customers and rarely expand its use until “requested” to do so by these customers.



### B. Nature and Level of Trading Partner Support

Many authors advocate the use of incentives and subsidies to entice smaller firms to begin using EDI and to expand its use further. As Table 2 clearly demonstrates, the trading partners of Kentucky small firms have not heeded this advice as well. Respondents from the sample firms were asked to rate the *level of support received* from their trading partners on an interval scale, with "1" indicating that "no support was received" and "3" indicating that "substantial support was received." Sample-organizations report receiving moderate to no support from trading partners in all support categories. The average "support received" score is the highest for EDI implementation (1.76) and Education and Training (1.64). This is consistent with past research and with the fact that "hub" trading partners tend to provide some education and/or training support and also do pilot testing of new EDI transactions.

**TABLE 2: EDI SUPPORT FOR SURVEYED-ORGANIZATIONS  
(DESCRIPTIVE STATISTICS)**

EDI Support Category	N	Mean
Implementation	85	1.76
Education & Training	85	1.64
Software	85	1.52
Maintenance	85	1.40
Telecommunication costs	85	1.29
Hardware	83	1.25

### C. EDI Benefits Realized by Responding Firms

In order to explore the nature of benefits realized by Kentucky SMEs, respondents were asked to rate the extent to which various benefits were obtained by their enterprise on a "relative advantage" scale from 1 to 5. The ratings ranged from substantially deteriorated ("1") to "no change" ("3") to "substantially improved" ("5").

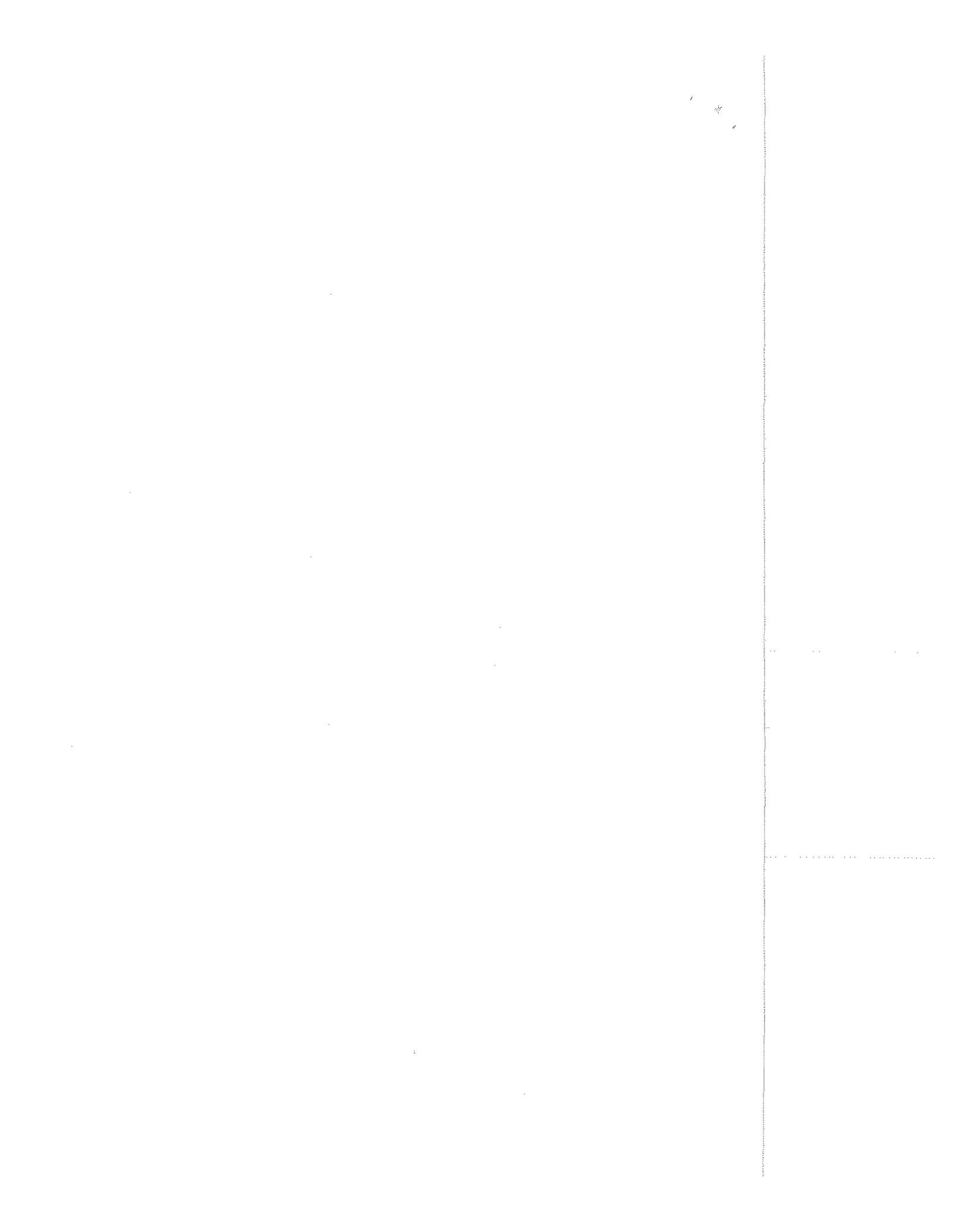


TABLE 3: CHANGE IN EDI BENEFITS (DESCRIPTIVE STATISTICS)

<b>EDI Benefits Realized</b>	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>
Quality of Information	82	2	5	3.87
Relationship with Trading Partners	80	1	5	3.85
Customer Service	82	1	5	3.61
Ability to Compete	81	3	5	3.59
Operational Efficiency	81	1	5	3.58
Cash Flows	81	2	5	3.36
Transaction Costs (reverse coded)	81	1	5	2.69
Inventory Levels (reverse coded)	80	2	5	2.76

Each one of the benefits listed in Table 3 is significantly different from the middle scale value of 3.00 ("no change") when a one-sample t-test was applied at the 95% confidence level. In other words, respondents reported achieving an extremely small but statistically significant positive (or negative) change in each of the listed benefits due to the implementation of EDI in their organization. It should be noted that "inventory levels" and "transaction costs" are reverse-coded and therefore a deterioration (or decrease) in them has a positive influence on realized benefits.

The mean scores for all the individual EDI benefits clearly support this conclusion. However, it is surprising to note that none of the listed benefit categories has a mean score that falls in the slightly to substantially improved (or increased) or slightly to substantially deteriorated (or decreased) range. Of course, there are individual firms in the sample that report having achieved substantial benefits from EDI, but on the average this is obviously not true.

#### D. Alternatives to EDI: EDI vs. FAX and E-mail

Respondents from sampled firms were asked to identify the percentage of documents exchanged with business partners using EDI, Fax and E-mail. Table 4 presents the total frequencies for the combination of each method and percentage of documents exchanged with trading partners.

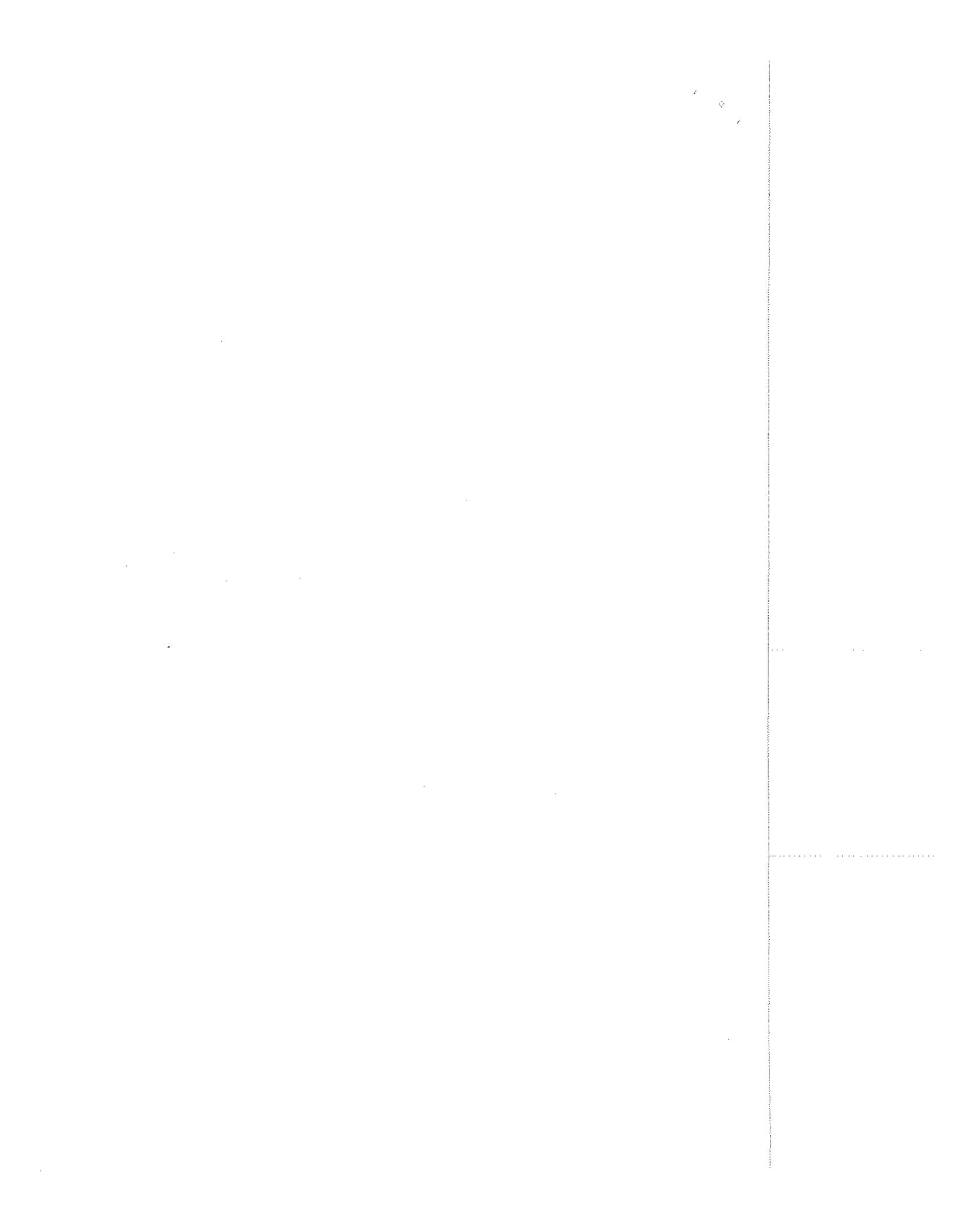
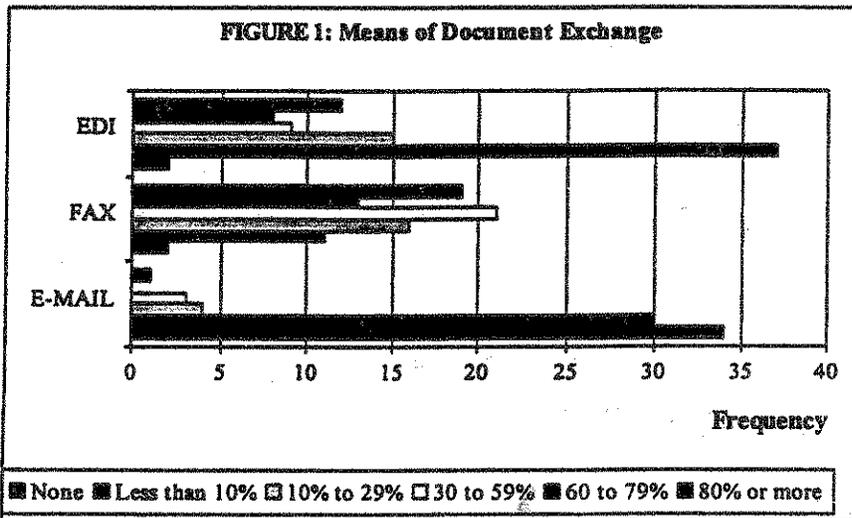


TABLE 4: EDI, FAX, & E-MAIL

Percentage of Documents Exchanged With Trading Partners	E-MAIL (N = 72)	FAX (N = 82)	EDI (N = 83)
None	34	2	2
Less than 10%	30	11	37
10% to 29%	4	16	15
30 to 59%	3	21	9
60 to 79%	0	13	8
80% or more	1	19	12



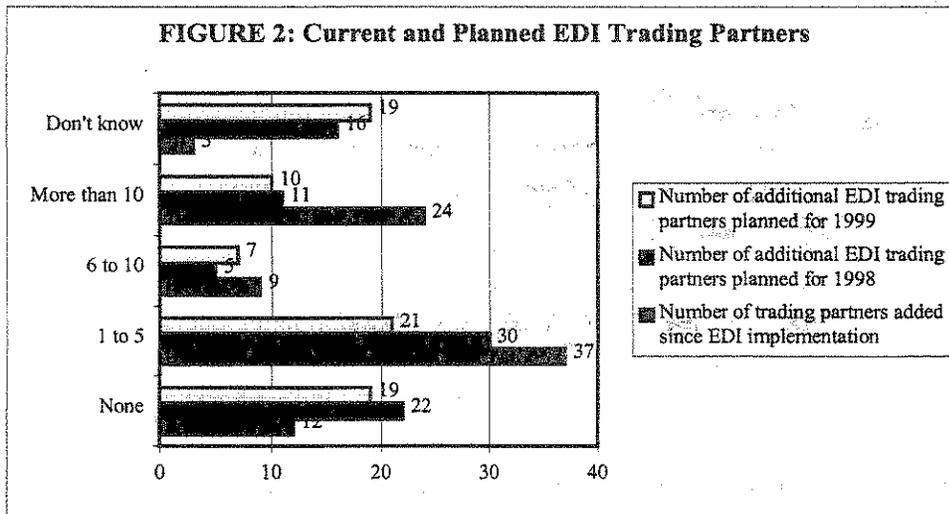
Further, a majority of surveyed-organizations currently still use FAX as an alternative or complementary means of exchanging business documents. Nearly one-half of the sample firms use both EDI and FAX to exchange between 10% to 80% of their documents (as depicted in Figure 1). Not surprisingly, E-mail is used to exchange a very small percentage of business documents with trading partners.



E. Number of Trading Partners

In order to assess the growth of EDI usage, respondents from surveyed-organizations were asked to identify the number of trading partners they currently have and those they plan to have in the next two years (1998-99).

As depicted in Figure 2 and detailed in Tables 5A through 5C, nearly 82% of sample-organizations have added trading partners, with more than half (54%) adding between 1 to 10 partners and the remainder adding more than 10. Furthermore, a significant proportion of the surveyed-firms plans to add between 1 to 10 trading partners in 1998 and 1999 (41% and 36% respectively, as shown in Tables 5B and 5C). Interestingly, 13% of the firms plan to add more than 10 trading partners in each year.



**TABLE 5A: NUMBER OF TRADING PARTNERS ADDED SINCE EDI IMPLEMENTATION (N=85)**

Number of Trading Partners	Frequency	Percent of Responses
None	12	14.1%
1 to 5	37	43.5%
6 to 10	9	10.6%
More than 10	24	28.2%
Don't know	3	3.5%

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**TABLE 5B: NUMBER OF ADDITIONAL EDI TRADING PARTNERS PLANNED FOR 1998 (N=84)**

Number of Trading Partners	Frequency	Percent of Responses
None	22	26.2%
1 to 5	30	35.7%
6 to 10	5	6.0%
More than 10	11	13.1%
Don't know	16	19.0%

**TABLE 5C: NUMBER OF ADDITIONAL EDI TRADING PARTNERS PLANNED FOR 1999 (N=77)**

Number of Trading Partners	Frequency	Percent of Responses
None	19	24.7%
1 to 5	21	27.3%
6 to 10	7	9.1%
More than 10	10	13.0%
Don't know	19	24.7%

F. Growth in Diversity of EDI Transaction Types

Surveyed firms were asked to identify the type of EDI transactions they currently use and plan to use. As seen in Table 6, a large number of firms plan to implement additional EDI transaction sets. Also, a number of firms appear to be moving towards implementing a diversity of transactions including those for billing and payment such as receiving advice and electronic funds transfer. This has been a weak area for small firms in the past for small firms.

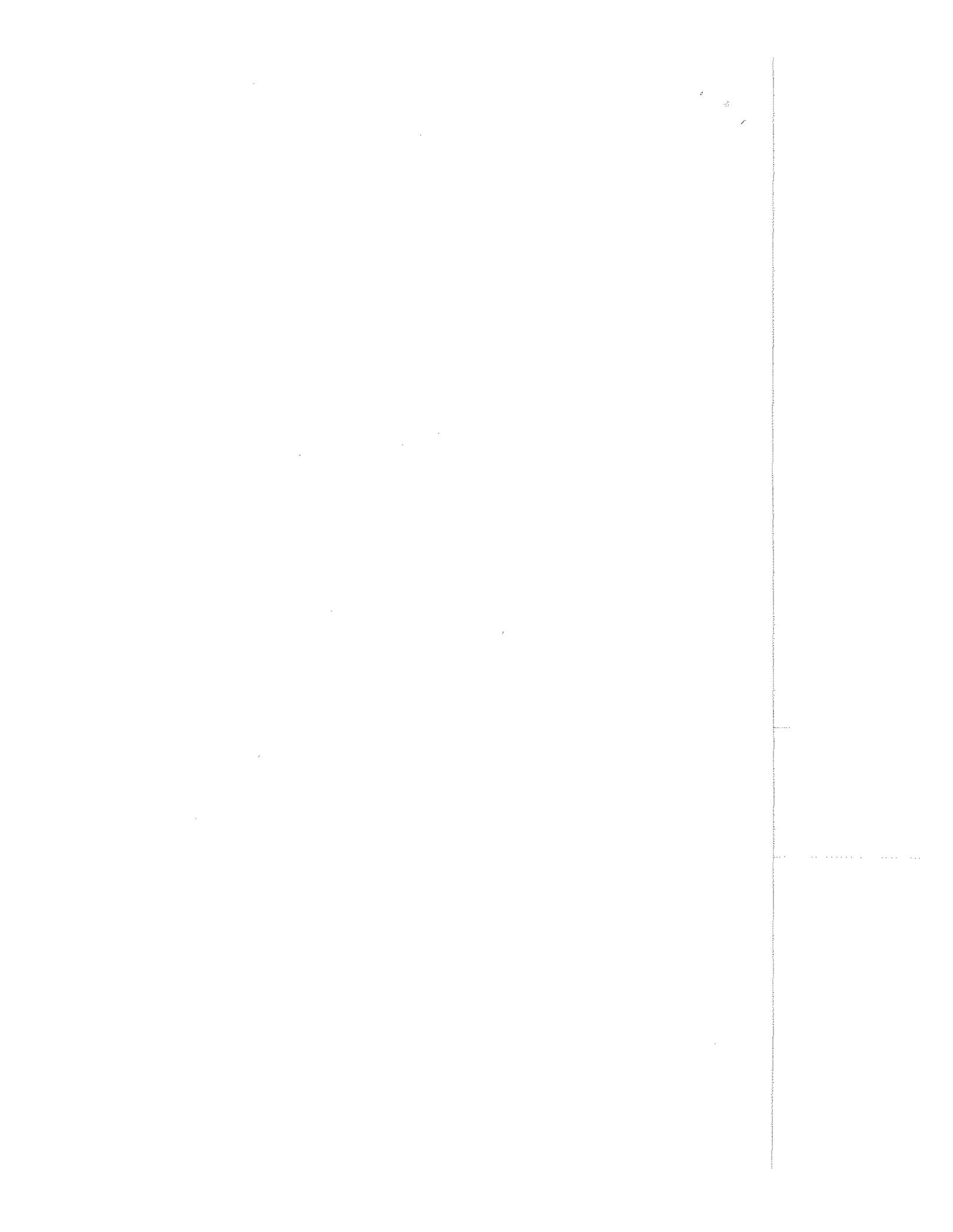


TABLE 6: TYPE OF EDI TRANSACTION (CURRENT &amp; PLANNED)

Type of EDI transaction	Using Now (Frequency)	Plan to Use (Frequency)
<b>Purchasing/Order Management/Administration:</b>		
Purchase Order (850)	58	13
PO Acknowledgment (855)	38	16
PO Change Request (860)	17	15
PO Change Acknowledgment (865)	14	13
Order Status Inquiry (869)	5	11
Order Status Report (870)	10	11
Price/Sales Catalog (832)	7	9
<b>Sales Analysis/Inventory Management</b>		
Planning Schedule/Release (830)	18	7
Inventory Advice (846)	6	6
Product Activity Data (852)	7	8
<b>Billing/Payment:</b>		
Invoice (810)	36	18
Credit/Debit Adjustment (812)	6	12
Receiving Advice (861)	8	7
Payment Order/Remittance Advice (820)	13	10
Lockbox (823)	1	4
Application Advice (824)	4	1
Electronic Funds Transfer (EFT)	11	13
<b>Shipping/Receiving:</b>		
Advance Shipping Note/Manifest (856)	25	16
Shipping Schedule (862)	11	7
Shipping Status Inquiry (213)		6
Carrier Shipment Status (214)	2	4
<b>Bidding/Quotation:</b>		
Request for Proposal or Quotation (840)	10	9
Award Notice (836)	8	5
Text message	17	4
<b>Partner Information/Acknowledgement</b>		
Organizational Relationships (816)	1	4
Functional Acknowledgement (997)	28	4
<b>Other EDI transactions</b>	18	
<b>Total Responses</b>	<b>379</b>	<b>233</b>

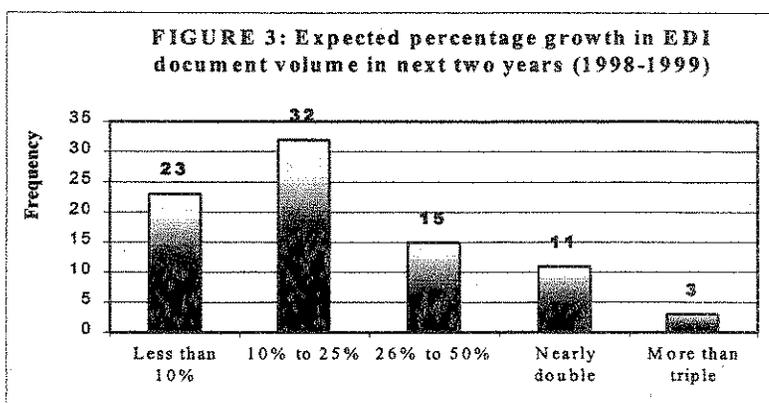
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### G. Growth in Volume of EDI Communication

Survey respondents were asked to project the growth in EDI document volume for their firms in the next two years. As depicted Figure 3, nearly 55% of the sample firms expect EDI document volume to grow between 10% to 50% in the next two years. It is interesting to note that nearly one-third of the firms project doubling and tripling the EDI document volume in the next two years (13% and 4% respectively).



### H. Plan to Upgrade EDI Platform

It was asserted in an earlier section of this article that nearly 35% of surveyed organization still used a DOS platform to run EDI software. As presented in Table 7, it is not at all surprising to find that nearly 70% of the sample firms expect to upgrade their EDI software in the next year (i.e., 1998). Furthermore, another 19% of the firms to expect to upgrade their EDI platform in the next 2 to 4 years and an additional 5% in the next five years and beyond. Only a small minority for firms (6%) did not have any plan to upgrade their EDI platform.

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TABLE 7: UPGRADE PLAN FOR EDI SOFTWARE (N=80)

Time frame	Frequency
Never	5
Next 1 year	56
2 to 4 years	15
5 years and beyond	4

## I. EDI and International Trade

Although UN/EDIFACT is an international standard for EDI transmission and is available as an option in many EDI software packages, very few firms in the United States of America use it. As international trade moves to EDI-based transaction processing in the next five years, small- and medium-sized firms will be left with no choice. With this in mind, respondents from surveyed-organizations were asked whether they expected to use EDI for International trade.

TABLE 8: PLAN TO USE EDI FOR INTERNATIONAL TRADE (N=85)

Plan for International Trade	Frequency
Not applicable (Do not import or export goods/services)	27
Yes, very likely	12
Perhaps, somewhat likely	16
No, unlikely	22
Don't know	8

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international trade (as detailed in Table 8). It is also worth noting that, nearly one-third (32%) of the sample firms did not export or import goods/services.

#### IV. Concluding Remarks

A substantial majority of small firms do not adopt EDI proactively. They are forced to do so by their major customers. Very little long-term thought is given to the costs and benefits of EDI implementation. Since benefits of EDI generally accrue in the long-term, firms are reluctant to expand the use of EDI. This results in moderate to no change in profitability for the EDI-capable companies. Furthermore, the fact that some government procurement agencies (DoD) have reduced the number of EDI-based transactions after forcing a number of SMEs to adopt EDI has been a great disincentive to EDI users, and especially new adopters. Further the survey results show that a number of firms are still using Fax for exchanging business documents. Notwithstanding all these challenges, Kentucky SMEs are planning to use more EDI transaction types, expend money on upgrading EDI software, add additional EDI trading partners, increase volume of trading partner documents communicated via EDI, and use EDI for international trade when possible.

#### References

Phillips Business Information, Inc. (Eds.), *Phillips 1997 EDI Yellow Pages* (Potomac: Phillips Business Information, Inc., 1997).

Khazanchi, D., *The Organizational Impact of Electronic Data Interchange on Kentucky Small- and Medium-Sized Enterprises* (Highland Heights: Northern Kentucky University, 1997).

Additional references are available from the author.

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