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IMPLEMENTATION OF ELECTRONIC DATA INTERCHANGE IN THE DEPARTMENT OF DEFENSE: LESSONS LEARNED FROM PRIVATE INDUSTRY

by

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The Department of Defense (DoD) has emphasized Electronic Data Interchange (EDI) since 1988 when the Deputy Secretary of Defense issued a policy directive that EDI was to become "the way of doing business" for DoD in the future. The focus of this research is on how private industry is implementing EDI, and specifically how EDI is being used in the procurement and acquisitions environment. The results from a survey of private industry showed that 1) EDI use will continue to grow in the procurement environment and that most impediments to EDI will be resolved with time and experience; 2) EDI must be adopted by the critical mass before the full benefits and savings will be recognized by DoD and industry; 3) top level management support and a detailed, well thought out strategic EDI plan are mandatory for successful implementation of EDI; and 4) the transaction sets currently being used by private industry for procurements and acquisitions limit DoD EDI opportunities for large purchases. Recognizing these conclusions, recommendations to DoD are then presented.

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Implementation of Electronic Data Interchange in the
Department of Defense: Lessons Learned From Private Industry

by

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ABSTRACT

The Department of Defense (DoD) has emphasized Electronic Data Interchange (EDI) since 1988 when the Deputy Secretary of [illegible] e issued a policy directive that EDI was to become "the way of doing business" fo[illegible] n the future. The focus of this research is on how private industry is implementing EDI, and specifically how EDI is being used in the procurement and acquisitions environment. The results from a survey of private industry showed that 1) EDI use will continue to grow in the procurement environment and that most impediments to EDI will be resolved with time and experience; 2) EDI must be adopted by the critical mass before the full benefits and savings will be recognized by DoD and industry; 3) top level management support and a detailed, well thought out strategic EDI plan are mandatory for successful implementation of EDI; and 4) the transaction sets currently being used by private industry for procurements and acquisitions limit DoD EDI opportunities for large purchases. Recognizing these conclusions, recommendations to DoD are then presented.

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I. INTRODUCTION

A. GENERAL

Electronic data interchange (EDI) is the computer-to-computer communication of business data in a standardized electronic format. Businesspeople around the world have advocated EDI as one of the most important advances in computer technology applications to improve productivity. Since it was first introduced into the transportation industry in the late 1960's, the use of EDI in the private sector has steadily increased [Ref. 1:p. 68]. Currently, over 30,000 companies are listed in the EDI Yellow Pages.

The Department of Defense (DoD) has emphasized EDI since 1988 when the Deputy Secretary of Defense issued a policy directive that EDI was to become the "way of doing business" for DoD in the future. Currently, the DoD has approximately 70 EDI projects under way. Once EDI is fully implemented every invoice, receipt, proposal, and contract will be exchanged electronically between suppliers and DoD without human intervention.[Ref. 2:p. v]

Although EDI applications are conducive to many different areas of private business, its use is very promising in the Government procurement and contracting environment [Ref. 3:p. iii]. The benefits private industries have recognized from

EDI include a dramatic decrease in paper usage, more accurate records, lower data entry costs, elimination of mailing costs, decrease paper handling, reduced inventory levels, and reduced order time. The lessons learned from industry in implementing EDI would be very beneficial to DoD as it moves toward expanding the role of EDI in acquisition and contracting.

B. OBJECTIVE OF THE RESEARCH

The purpose of this research is to determine how EDI is being used in private industry and how that information can be used to enhance "electronic commerce" in the Department of Defense. Specifically, the study will focus on problems encountered by industry during the implementation and operation of EDI and how these problems were overcome. Additionally, new and innovative technology applications in acquisition and contracting will be examined.

C. RESEARCH QUESTION

Given the preceding objectives, the following primary research question is posed: How is electronic data interchange (EDI) being utilized in private industry and how can it best be used to facilitate the implementation of Electronic Data Interchange in the Department of Defense?

The following secondary research questions are deemed pertinent to this research effort:

1. What is electronic data interchange?

2. What are the principal EDI applications in the private sector acquisition and contracting environment?

3. How are industries sending, receiving, and interpreting EDI transactions?

4. What transaction (document) types are currently being utilized in the acquisition and contracting environment?

5. What problems have been encountered during the implementation and operation of EDI and how have they been resolved?

6. What are the security and integrity issues with EDI transactions and what is being done to resolve them?

7. Can industry EDI applications be effectively and efficiently utilized in DoD acquisition?

D. SCOPE AND ASSUMPTIONS

There have been numerous studies on how DoD can best utilize EDI to enhance areas of logistics, procurement, transportation, personnel property shipping, and electronic funds transfer. Most of these studies have been approached by examining the capabilities of EDI and then matching the capabilities to potential opportunities within DoD and to the advancement of electronic commerce in DoD. This thesis will concentrate on how private industry is implementing EDI and how EDI is being used to streamline and improve the acquisition and contracting fields.

The reader is assumed to have a basic knowledge of the Department of Defense acquisition environment and general knowledge of contracting and contract types.

E. METHODOLOGY

The methodology involved in this research consists of four segments: (1) development of a literature base, (2) a mailed survey to private industry, (3) telephone and personnel interviews with DoD agencies and private industry representatives, and (4) attendance at Northern California EDI User Group Meetings. The literature base was developed using the Defense Logistics Studies Information Exchange (DLSIE) and the Dudley Knox Library at the Naval Postgraduate School.

A survey was mailed to 425 different companies, both large and small, representing a wide range of industries in varying stages of EDI implantation. All companies surveyed were members of the Data Interchange Standards Association, Inc. (DISA). Beyond the survey, telephone interviews were conducted with representatives from the Defense Logistics Agency (DLA), the Naval Aviation Supply Office (ASO), and the Navy program office for EDI. Lastly, numerous contacts were made with representatives of companies from the surrounding area while attending several Northern California EDI Users Group meetings.

F. ORGANIZATION OF THE THESIS

This thesis is organized into five chapters. The first chapter is an introduction to the thesis. Chapter II provides a historical background of the development of EDI, defines EDI, and discusses current benefits of and problems with EDI in the acquisition environment. Chapter III covers the survey development and a presentation of data collected. In Chapter IV, the data and information collected is analyzed and interpreted. Chapter V presents the researcher's conclusions and recommendations.

II. BACKGROUND

A. INTRODUCTION

Advanced information technologies offer the potential for tremendous changes in the way business, as we know it today, is conducted. Electronic data interchange (EDI) is one such technology. However, EDI is only a tool used to achieve *electronic commerce (EC)*, the technology that promises to eliminate the use of paper in business transactions and completely automate all business functions.

The purpose of this chapter is first to familiarize the reader with exactly what EDI is and how it is transmitted. Next, the hardware and software requirements will be reviewed. In addition, some of the current benefits recognized with EDI will be discussed and some potential impediments to EDI will be covered. Lastly, three current applications of EDI will be presented followed by a summary of material covered in this chapter.

B. HISTORICAL BACKGROUND

EDI was first conceived by Edward A. Guilbert in the late 1940s as a way to speed up the flow of materials during the Berlin airlift [Ref. 1:p. 68]. Since the mid-1950s, business information has been communicated electronically in both large private companies and DoD. However, its use was limited due

to the lack of any standard transmission format. The first standards were developed by the Transportation Data Coordinating Committee (TDCC) in the late 1960s and 1970s for the rail, motor, air, and ocean industries. With the successful implementation of EDI within the transportation industry, the grocery, chemical, and warehousing industries soon followed with their own standards. However, the use of EDI was still limited to use within a particular industry because the standards for one industry were not always compatable with those of another industry. Finally, in 1979, the American National Standard Institute (ANSI) formed the ANSI X12 standards that could cut across industry boundaries to electronically interchange digital business transactions between and among industry. [Ref. 4:p. 1.0.3]

In May 1988, the Deputy Secretary of Defense for Acquisition issued an EC/EDI policy memorandum which directed that DoD join the private sector as a full trading partner in EDI and make EDI "the way of doing business" [Ref. 2:p. 1]. In addition, the memorandum also mandated the use of ANSI X12 standards. The Defense Logistics Agency (DLA) was designated as the DoD Executive Agent for Electronic Data Interchange in May 1990 by the Deputy Secretary of Defense for Production and Logistics. As Executive Agent, DLA has the following responsibilities:

- Ensure compliance with policies and standards

- Provide standard implementation quidelines and established support agreements
- Establish and control standard support components for use throughout DoD
- Provide common user systems, facilities, and services where appropriate.
- Ensure a "single face to industry." [Ref. 5:p. 1-4]

In November 1990, Defense Management Review Decision (DMRD) 941 entitled *Implementation of Electronic Data Interchange in DoD* was released with the intent to accelerate the use of EDI by DoD through the programming of cost reductions into the budgets of each military department and the Defense Logistics Agency. The cost reductions reflect the direct savings projected with the use of EDI transactions in place of 16 paper forms currently used; however, the budget reductions will occur regardless of actual savings realized. Most of the potential savings from the implementation of EDI, estimated at $548 million over an eight year period, will occur in the financial/payment and procurement/contract administration areas [Ref. 5:p. 1-5]. To provide an incentive for adopting EDI, DMRD 941 gives DoD $85 million for a multi-year total investment in hardware, operators, maintenance, systems development, and engineering. In March 1991 the U.S. Department of Commerce, National Institute of Standards and Technology (NIST) issued Federal Information Processing Standards (FIPS) Publication 161. This publication announced the adoption of two EDI format standards, ANSI X12 (national)

and EDIFACT (international). It does not mandate the implementation of EDI but states that the use of one of the two standards is required, subject to certain conditions, when Federal departments or agencies implement EDI systems [Ref. 6:p. 1]. Federal departments or agencies using industry specific standards may continue to do so for a period of five years but are still required to submit their requirements for X12 or EDIFACT standardization. Currently both standards can coexist; but, by 1994 the X12 standards should be aligned with the EDIFACT standards [Ref. 6:p. 5].

C. WHAT IS EDI?

To fully understand how EDI works, several terms and concepts must be explained. First EDI must be defined. Next, several different EDI standards available should be explained. Finally, transaction sets should be more fully described.

1. Definition

EDI has been labeled the "key to paperless communications" [Ref. 1:p. 69]. In simple terms, EDI is the process of electronically transferring routine business documents in a pre-established, standard format (transaction set) from one organization's computer to another [Ref. 2:p. 2]. EDI is often confused with text electronic mail ("e-mail"), yet the computer technologies have one major difference that sets them apart.

With e-mail, a transaction may be sent electronically from one organization's computer terminal to another. Once received, this transaction must be read and manually processed to complete the transaction. For example, a major manufacturer may place an order for 1000 gallons of paint with one their local suppliers by keying in the request on the computer and then sending the order by interpersonal massaging (e-mail). Once the order is received on the suppliers computer, a supply clerk must then read the order, check the on hand balance, rekey the order in the computer, and then process the order for shipment. Figure 2.1 shows this arrangement.

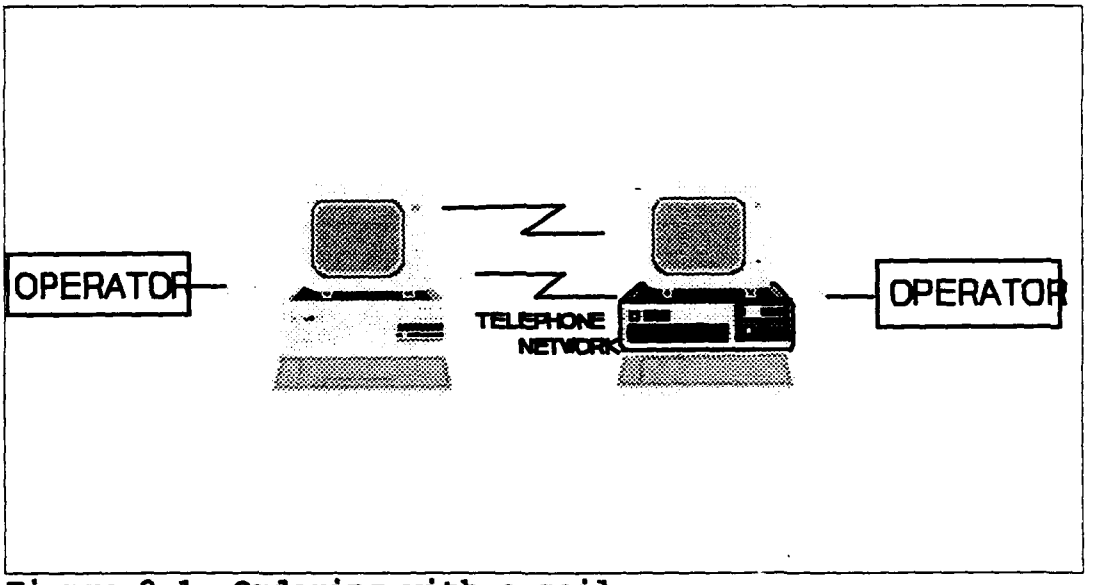

Figure 2.1 Ordering with e-mail
Source: All figures were developed by the researcher unless otherwise noted.

Alternatively, EDI puts the texts of a transaction in a standard, prearranged format. The transaction is formatted

so that the computer can be programmed to recognize and handle it without human intervention. Using the same example as above, the supplier's computer can read the order directly and automatically process and complete the order for 1000 gals of paint. Thus the major difference between EDI and e-mail is the use of standard formatted transaction sets. However, a formatted transaction may be received by the supplier's computer and still not be considered EDI if someone still must manually rekey the transaction to process the order. Figure 2.2 show a simple EDI ordering arrangement.

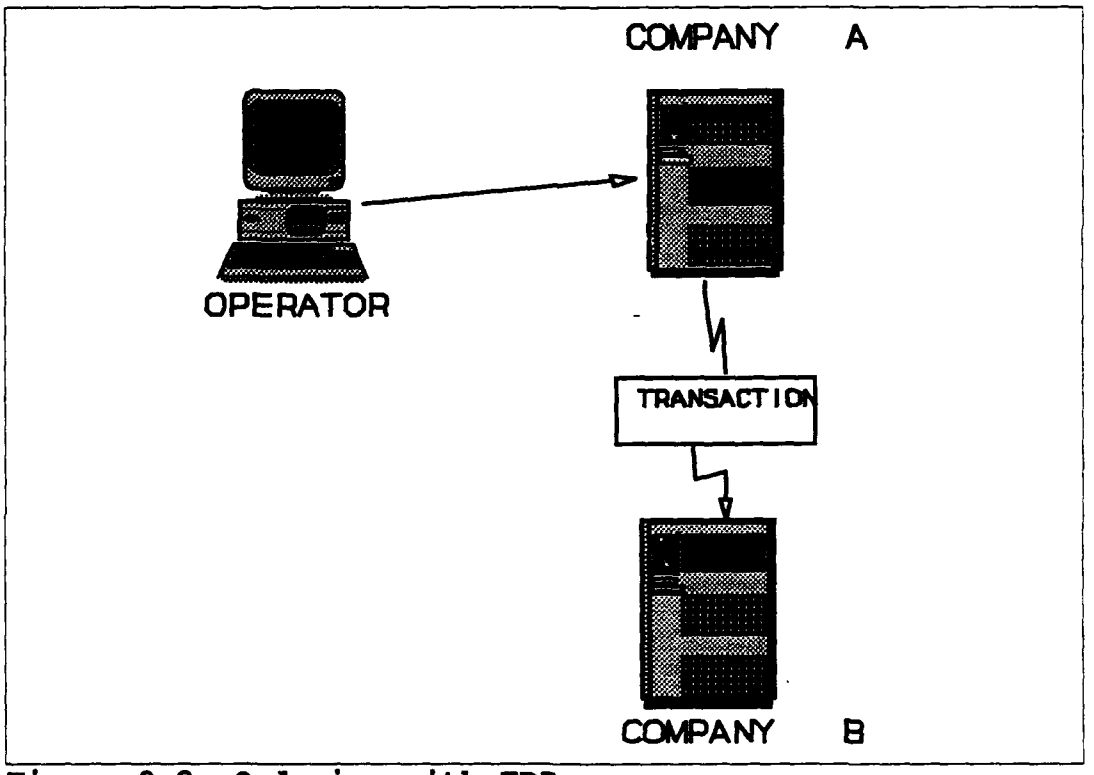

Figure 2.2 Ordering with EDI

2. EDI Standards

Prior to 1979, EDI standards were industry-specific standards established using proprietary or unique formats designed to support only intra-industry trading. However, a small portion of the standards such as bill of landing and freight invoices were applicable across industries. As the EDI environment evolved, the need to expand with trading partners outside industry boundaries grew. Companies who tried to conduct multi-industry transactions were faced with the problem of supporting a multitude on incompatible transactional EDI standards that were in a state of constant change.

In 1979, the American National Standards Institution (ANSI) chartered the Accredited Standards Committee (ASC) X12 to facilitate defining a "single, flexible, generic transaction set protocol" which would allow the exchange of electronic business information across a wide range of industry boundaries [Ref. 7:p. 2]. In 1983 the first five ASC X12 standards, based upon the standards developed by the Transportation Data Coordinating Committee and the National Association of Credit Management's Credit Research Foundation, were published [Ref. 8:p. 7].

Although many companies are still using proprietary EDI standards, most industries are converting to the ANSI X12 standards. In addition, many industries are developing and publishing "subsets" of ANSI X12 standards as industry

specific guidelines for implementation. These industry conventions are developed with the intent to facilitate the implementation of selected standards between members of the industry and their trading partners.

The X12 Committee is supported by the Data Interchange Standards Association Inc. (DISA), a not-for-profit organization which serves as its Secretariat. The responsibilities handled by DISA are as follows:

- Communicating with ANSI and the public on behalf of the committee
- Managing the standards database
- Publishing
- Planning and managing ASC X12 meetings and the annual EDI Conference & Exhibit
- Conducting ballots
- Handling membership and administrative matters
- Serving as the Secretariat of the North American EDIFACT Board (NAEB) [Ref. 8:p. 4].

Members of the X12 Committee and standard users are continually expanding the X12 standards to meet additional requirements. Any business or industry may present their requirements for additional EDI standards or maintenance to existing standards by simply sending them to DISA. Three times a year, ASC X12 convenes a five-day meeting open to over 750 members and participants. After each meeting, a series of ballots incorporating sub-committee approved documents is sent to X12 members for their approval. Those standards approved

are then published as draft standards for trial use and immediately placed in maintenance status. Once each year DISA publishes the entire set of standards, including revisions of previously published draft standards and new draft standards approved by ASC X12 during the year, in a publication called a release. Then at three-year intervals the latest release is reviewed for selection of appropriate draft standards for submission to ANSI to begin the national review process. Once approved by the public, the proposed standards are published as American National Standards and assigned a new version number. Although the approval process appears long and detailed, it assures only quality standards that are responsive to the needs of the users are released.

While ASC X12 is the major EDI standard in the United States, there is another primary standard available to EDI users. UN/EDIFACT stands for United Nations rules of Electronic Data Interchange for Administration, Commerce, and Transport. UN/EDIFACT is an international standards set comprised of agreed standards, directories, and guidelines for the electronic interchange of structured data that relate to trade in goods and services between independent, computerized information systems [Ref. 6:p. 5].

Under sponsorship of the United Nations, UN/EDIFACT standards development, maintenance and technical assessments is accomplished through input from various regional boards to the United Nations Economic Commission for Europe (UN/ECE).

The United States is a member of the Pan American EDIFACT Board (PAEB) along with all of North, Central, and South America. DISA serves as the administrator and secretariat for the PAEB. The PAEB meets twice a year and the meetings are open to anyone interested in UN/EDIFACT.

In 1994 ASC X12 should be aligned with Un/EDIFACT. Until then both standards can co-exist. The remainder of this thesis will refer only to ASC X12 standards since the vast majority of DoD EDI users subscribe to these standards.

3. Transaction Sets

The ASC X12 standards define the EDI transaction set as the computerized document format used in EDI as the means of communicating standard business transactions. In other words, a transaction set is really just an electronic equivalent of a paper document. A three digit number identifies a transaction set; for instance, the X12 transaction set 850 is actually a purchase order and transaction set 855 is a purchase order acknowledgement.

There is a hierarchical organization for EDI transactions based upon the following structures:

- Transaction sets
- Data segments
- Data elements

Transaction sets occupy the top-level in the EDI hierarchy. It is the transaction set which describes all the

groups of data necessary to communicate a complete document. The sequences of data within a transaction is also specified. Each EDI transaction set contains one or more data segments.

A data segment is subset of a transaction set much like a description of how much material to order is part of a paper document procurement order. The smallest of the EDI building blocks is the data element. A group of functionally related data elements fit together to make up a segment. For example, unit of issue and quantity are both included in the same segment because they both describe how much material to requisition. These elements represent the actual alphanumeric date, time, and other information related directly to a transaction.

Not all segments and elements are required to be used in a ASC X12 transaction set. Industry specific implementation guidelines are allowed some flexibility to provide further requirements. The following definitions apply:

- *Mandatory* (segments and elements) - defined by ASC X12
- *Optional* (segments) -use is determined by the trading partners.(elements) - used at the discretion of the sending party or upon mutual agreement between trading partners.
- *Required* (segments and elements) - considered optional under ASC X12 rules but is required by industry decision.
- *Recommended* (segments and elements) - considered optional under ASC X12 and by the industry, but the industry recommends their use to facilitate EDI.
- *Not Used* (elements only) - industry does not use

- *Conditional* (elements only) - depend on the presence of other data elements in the transaction set.[Ref. 4:p. 1.0.14]

It is this flexibility within the ASC X12 standards which causes some problems. The standard is still not a standard across all industries. Different industries require different elements and segment be used to meet their own conventions. The small companies that survive by doing business with different industries are still forced to handle more than one standard [Ref. 9].

D. RESOURCE REQUIREMENTS FOR EDI

Three general resources are required to interchange data electronically:

- Computer Hardware
- Computer Software
- Communications capability [Ref. 4:p. 1.0.3].

The configuration of these three resources vary from one activity/organization to another. A computer as large as a mainframe or as small as a personal computer with a modem can be used to communicate directly with a trading partner using translation software.

1. Computer Hardware

Some form of computer hardware is required at both the sending and receiving organizations to operate the business applications software and EDI translation software. What size computer and how much is spent on the computer will depend

upon a number of considerations such as: number of EDI transactions per day; processing speed, including that of translation software; and storage requirements, such as archiving a large number of documents [Ref. 10:p. 3-13]. The choices in computers are a mainframe computer, minicomputer, microcomputer, or some combination of the three.

The configuration of the computer hardware is just as important as the type of computer. Again, how the system is configured will depend on the size and nature of the business. In a host configuration, the EDI translation software resides in the same computer as the applications software. Such a configuration is used in a microcomputer-to-trading partner's mainframe approach or a mainframe-to-trading partner's mainframe approach. In both cases, the applications software and translation software are installed on the same computer; however, the applications software may have been modified to produce an X12 standard format directly on the mainframe approach.

In a front-end configuration, EDI translation software resides on either a microcomputer or minicomputer and the applications software is resident on a different computer (usually a mainframe). Here, the mainframe computer will transfer a digital business document such as a purchase order to the front-end computer on which the translation software resides. The front-end computer will then translate the user-

unique format into the standard format and transmit the standard formatted file to the trading partners.

2. Computer Software

A basic EDI system has three software components: translation software, communications software, and a mapping table. The translation software is principally used to format flat files of data to and from ASC X12 standard transactions. Translation software can also verify correctness of format, acknowledge receipt of transactions, and maintain transmission audit trails. In addition, most translation software packages contain the following security features:

- EDI log-on and password control features to restrict unauthorized use of software.
- Auto log-off feature which will automatically terminates and logs off a user after a certain time period has elapsed without any activity.
- Trading partner codes and passwords maintained by the translation software of each trading partner,
- EDI transmission control checking to maintain and ensure the integrity of EDI transmissions [Ref. 10:p. 3-14].

Communications software is usually packaged together with translations software. It helps to facilitate the exchange of information with an EDI Value-Added-Network (VAN) by first automatically dialing and establishing a connection with the VAN. Next, it actually sends and receives EDI formatted data to and from the VAN.

A mapping table is required for the translation software to work. Mapping is the process of informing the

translator of the relationship between each element of the flat files used by the internal computer systems and the elements of the ASC X12 transaction set [Ref. 11:p. 313]. In other words, when transmitting a purchase order, the mapping table tells the translation software where to find the purchase order number, item number, order quantity, and any other fields in the flat file.

To realize the full benefit of EDI, the EDI software must be integrated with the company's in-house accounting system. Otherwise, the company may actually increase the work load with the implementation of EDI. This is due to additional step of re-entering the same information from the EDI transaction into the company's in-house accounting system. Integration can be achieved by one of three kinds of software:

- Translation Software
- EDI Management Software
- Bridging Software [Ref. 12:p. 8].

Translation software may have built-in hooks to import/export a file to and from the in-house accounting software. This should be a major evaluating factor when selecting a translation software package [Ref. 12:p. 18]. Another way to integrate EDI into company's application software is provided by EDI management software. This software provides mapping of ASC X12 transactions directly into a file used by the applications software. However, there is usually additional programming required to establish the

link between the two software systems [Ref. 12:p. 16]. Bridging software is the best available integration software available currently. Unlike translation and EDI management software, bridging software requires no additional programming or keypunching by the operator. In addition, the bridging software looks and feels like the in-house accounting system, a feature referred to as a "seamless" interface . The operator may not even know that the bridging software has been installed [Ref. 12:p. 8].

3. Communications Capability

The last resource requirement for EDI is a communication capability. This can easily be met with a simple modem and direct dialing to the trading partner's computer. Another alternative is to obtain the services of a third-part or VAN. The VAN can be a commercial or Government network which functions as a clearing house between an activity/company and its trading partners. The activity/company can transmit all of its purchase orders, invoices, shipping documents, technical specification, and other electronic transaction to the VAN in a single session. Once received by the VAN, the transactions are retransmitted and deposited into each trading partner's "electronic mailbox." The trading partners can then dial the VAN, receive their transactions, and deposit new transactions for others, all in one session [Ref. 4:p. 1.0.4]. The VAN takes care of

any compatibility problems between different systems and is used extensively both commercially and within DoD.

VANs are also able to provide other services. One of the services, provides an audit trail of time and place or origination and receipt, is also one of the most critical in a procurement environment. Another useful service provided by VAN's is the mailing of multiple copies of a transmission for distribution and the ability to retain transmissions until each recipient's computer is able to receive the transmission directed to it. Finally, most VANs are able to perform some security and authentication services.

E. BENEFITS OF EDI

With the 1988 directive from Deputy Secretary of Defense, DoD set out to identify the means of converting to a near paperless system using EDI. The Logistics Management Institute (LMI) identified 16 DoD documents as the best candidates for conversion to EDI [Ref. 13:p. 2-1]. By replacing the 16 commonly used paper documents with their electronic equivalent, DoD could save $98 million over a 10-year period [Ref. 13:p. 2-17]. Table 1 provides a listing of the 16 documents targeted for EDI conversion and implementation as identified by the LMI report. The cost savings can be directly contributed to reduced costs associated with distribution; mailing; sorting; reconciling and auditing; data entry, which can occur several times if the

same information is entered into more than one computer system; error resolution; storage and retrieval; and possibly telephone charges from placing orders by phone [Ref. 10:p. 3-2].

Changes in business practices made possible by EDI may also result in the following indirect benefits:

- Reductions in inventory
- Improvement in customer service
- Streamlined operations
- Improved quality control
- Enhanced contract management and auditing
- Increased price discounts
- Reduced interest payments [Ref. 10:p. 3-2].

The RAND National Defense Research Institute conducted an analysis on how EDI can directly improve logistics processes. the analysis indicated five target areas as follows:

- A shortening of procurement administrative lead time (PALT),
- A broadening and hastening of access to the industrial base,
- The allowing of tighter and more dynamic control over vender performance,
- Providing short-term "heads up" to logistics pipeline participants both within and outside DoD, and
- Allowing for better resources to unpredictable surges in demand for critical goods or services. [Ref. 2:p. 68]

TABLE 1

EDI DOCUMENT CONVERSION POTENTIAL SAVING OVER A 13 YEARS

OPPORTUNITY AREA/DOCUMENT		TOTAL SAVINGS ($ MILLIONS)
PROCUREMENT/CONTRACT ADMINISTRATION		
DD Form 1155	-Order for Supplies and Services	36.9
SF 18	-Request for Quotations (written)	4.5
SF 18	-Request for Quotations (telephone)	13.8
SF 30	-Amendment of Solicitation/Contract Modification (local)	12.6
DD Form 250	-Material Inspection and Receiving Report	14.3
SF 129	-Solicitation Mailing List Application	0.9
SF 1443	-Contractor's Request for Program Payments	0.5
SF 30	-Amendment of Solicitation/Contract Modification (non-local)	1.0
	Subtotal	**84.5**
Transportation		
SF 1103 SF 1113	-Freight GBL, and -Public Voucher	7.2
SF 1203 619/691-1 SF 1113	-Personal Property GBLs, Statement of Accessorial Services Performed, and Public Voucher	3.6
SF 1169 SF 1113	-Government Travel Request and Public Voucher	0.7
-------	-Voucher Stub and Check	0.2
MT 364R	-Standard Tender	0.1
	Subtotal	**11.8**
Supply/Maintenance		
SF 364	-Report of Discrepancy (supply)	0.6
SF 926	-Monthly Report of Repairable	0.5
SF 368	-Product Quality Deficiency Report	0.1
SF 361	-Transportation Discrepancy Report	0.1
	Subtotal	**1.3**
Fuels		
DD Form 1898	-Aviation Fuels Sales Slip	0.4
	TOTAL	**98.0**

Source: Hardcastle, and Heard, *A business Case for Electronic Commerce*, LMI report DL001-06R1, p. 2-17, September 1990.

Of the five target areas, the first two are directly applicable to the utilization of EDI in the acquisitions and contracting environment. The LMI report noted two ways in which PALT could be shortened.

> *It *shortens presolicitation* by abbreviation of the time needed to announce the intent to solicit. EDI also simplifies the search for competitive vendors by (1) reaching preidentified vendors both faster and simultaneously: (2) allowing vendors to identify themselves; and (3) better tapping non-DoD markets. It *shortens solicitation or order placement* by (1) exchanging the required multiple transactions electronically; (2) automatically incorporating these transactions into internal contracting systems for action; (3) soliciting all qualified and interested vendors simultaneously; (4) placing orders electronically against existing contracts; and (5) using electronic access to basic ordering agreement vendors to speed up pricing or other terms of an order. [Ref. 2:p. 18]

The other important way EDI could benefit the acquisition and contracting environment is by improving access to the industrial base. Two current problems with the industrial base are:

- Too many of DoD buys are from single sources, limited sources, or from foreign suppliers.
- Too many commercial firms decline to do business with DoD because of the sheer weight of compliance with the regulations, reporting requirements, and body of law. In addition, many are concerned about the slowness of payments [Ref. 2:p. 31].

EDI can help solve the first problem through the use of electronic tools such as bulletin boards and cross-vendor databases [Ref. 2:p. 34]. DoD can list requirements in an

electronic bulletin board thereby allowing easy accessibility to firms who might not otherwise know about that requirement. A firm might already be producing that requirement or might decide it is worthwhile to start producing it. In addition, an electronic cross-vendor database could assist DoD in locating suppliers of items that might otherwise be sole-sourced. The potential benefits of either one of these tools is well worth the investment.

EDI can be used to reduce the effort required by Vendors to do business with DoD by using standard EDI X12 formats. The vendors will than be able to conduct business with DoD just as they do with other EDI trading partners. In addition, EDI can significantly speed up payments to vendors through applications like electronic funds transfer (EFT).

In summary, EDI offers DoD both direct and indirect benefits. In addition, LMI determined that DoD could save almost 15 times the initial investment cost over a 13 year period with investments totalling 70 million and savings totaling almost 1.2 billion [Ref. 13:p. 2-17].

F. Current EDI Issues In Procurement

As EDI gains acceptance as the "way of doing business in DoD" several implementation hard spots have surfaced. The Federal Government has passed many laws and regulations over the years to minimize fraud and other criminal actives associated with Federal procurement. The introduction of new

EDI technologies have come in direct conflict with many of these regulations [Ref. 2:p. 64-65]. Unless these conflict are resolved, the implementation of EDI acquisition and contracting applications within DoD could be severely hampered. The purpose of this section is to discuss the issues of Federal regulations, electronic signatures and security, EDI trading partner agreements, and small business.

1. EDI and Federal Procurement Regulations

The primary problem with both the Federal Acquisition Regulations (FAR) and Defense Federal Acquisition Regulations Supplement (DFARS) is that they are becoming rapidly outdated by advances in technologies. This is, in part, because the regulations were written when paper was the only means to conduct contractual business. LMI conducted a part-by-part review of the FAR and DFARS to identify impediments to paperless processes and ways to facilitate the use of electronic techniques in both large procurement actions and small purchases.[1] What the reports found was that both regulations have been modified in recent years to recognize such technologies as electronic funds transfer and facsimile transmission of bids. However, technologies such as EDI, E-

[1]The results of these three studies are listed in the appendix of the following LMI reports: report DL203R1, *Electronic Commerce, Removing Regulatory Impediments*, May 1992; report PL904R1, *Electronic Data Interchange In Procurement*, April 1990; and report PL006R1, *Electronic Commerce and Competitive Procurement*, June 1991.

mail, optical disks , CD-ROM, VANs, and rational data bases were never mentioned in the either of the two regulations. [Ref. 14:p. 5.1]

There are several examples where flexibility or technology neutrality is written into the FAR and DFARS. For instance, FAR part 33.211(b) states that the contracting officer shall furnish the contractor a copy of the decision by certified mail, return receipt requested, *or by any other method* that provides evidence of r ·ipt [Ref. 14:p. 5.2]. By adding "or by any other method" the FAR allows the use of EDI transactions (along with receipt verification) instead of a paper copy. LMI recommended that similar, technology neutral language be placed elsewhere in the FAR and DFARS. This flexibility will encourage not to impede the progress of EDI.

2. Electronic Signatures and Security

One of the most notable impediments to the utilization of EDI in the procurement environment is that of electronic signatures. For example, FAR part 4.102(a) states that the contracting officer's signature shall be followed by the his typed, stamped, or printed name. In the past it could only be assumed that an electronic signature would not meet the signature requirement in accordance with the FAR.

In a legal sense, two requirements must be met before a electronic signature could be considered binding. First the electronic signature must be adopted as a person's "unique

code signature." Secondly, appropriate security measures must exist to ensure that the "code" cannot be accessed by unauthorized individuals [Ref. 15:p. 5-1].

The first requirement has not been difficult to overcome. With respect to legally binding signatures, the courts uniformly acknowledge that the operative condition is the "intent" to use the marking or other discrete authentication code as one's signature rather than the marking or code itself [Ref. 15:p. 5-2]. Therefore, all that must be done is show that the maker of the "symbolic signature" intended to be legally bound by the law. The basic trading partner agreement should be able to overcome this requirement.

Public key encryption is available to provide suitable security protection to meet the second requirement. However, it was not until recently that the National Institute of Standards and Technology (NIST) issued a draft Federal Information Processing Standards Publication (FIPS PUBS) which specified a Digital Signature Algorithm (DSA), appropriate for applications requiring a digital rather than a written signature, as the digital signature standard (DSS). DSA is based on public key encryption. Once this DSS is approved by the Secretary of Commerce, the issue of electronic signature should be resolved. In spite of the acceptability of electronic signatures, the issues of security and signatures should be addressed in a trading partner agreement.

3. Trading Partner Agreements

Most issues associated with EDI will be resolved as more applications of EDI are developed and DoD gains experience with the prototype EDI contracting systems currently in operation. In the commercial environment, the use of trading partner agreements is accepted as legally sufficient to bind all EDI partners to an EDI generated contractual business transaction. [Ref. 16:p. 4-1] The enforceability of electronic communications is enhanced by a trading partner agreement as long as certain electronic transaction conventions are met. Specifically, the agreement should address the use of standards and transaction sets, third-party service providers (including payment of services), timing of message transmissions, and errors in transmission. In addition, the trading partner agreement should include procedures to ensure disputes resolution, security of data, and authentication of the electronic signatures. Any special terms and conditions may be added as needed to provide efficient trading operations. [Ref. 4:p. 3.0.11-13]

The importance of a trading partner agreement to the protection of both trading partners can not be over emphasized. It is the key document setting forth the rights and obligations of the parties. As such, it should be drafted and executed with the aid of legal counsel.

4. Small Business Interest

It is the policy of the Federal Government that the Government Contracting Officers should procure goods and services from small businesses, small disadvantage businesses, and woman-owned businesses to the maximum extent practicable. One final EDI issue that has caused some concern for both Congress and the Small Business Association (SBA) is that EDI is not a practical consideration for many of the small business that routinely conduct business with the Government. In particular, it is feared that the hardware, software, and knowledge requirements will force many small business to be non-responsive to Government solicitations. These requirements will be address in this section.

a. Hardware

There is a valid concern that EDI will place techological barriers to small businesses as they try to compete for Government business. The estimated investment in the minimum EDI-related hardware is approximatily $2,500 for a personal computer, modem, and printer [Ref. 14:p. 6-12]. However, a recent survey conducted for DLA has concluded that 65 percent of small businesses possess the equipment necessary to receive and respond to a request for quotation (RFQ) using standard EDI technology. In addition, 92 percent of the small businesses surveyed stated that they "would consider investing a reasonable amount of dollars in EDI hardware and software in

order to increase participation in DoD EDI implementation." [Ref. 17:p. 3-14]

From the results of this survey, it appears that the requirement to procure EDI hardware would not impede most small businesses from conducting business with the DoD using EDI. For those businesses that cannot afford the required investment in hardware, perhaps EDI capable systems can be made avaliable to them at the closest Federal procurement center. This was done at the Naval Supply Center in Jacksonville, Flordia in conjuction with an EDI contracting system called Electronically Assisted Solicitation Exchange (EASE) with very good results [Ref. 14:p. 6-9].

b. Software

Another major concern is the lack of availability of EDI-capable business application software to small businesses [Ref. 15:p. 6-5]. EDI communications software is relatively inexpensive at around $300 on the low end of the scale. With this software or with the use of a VAN, the business would have EDI capabilities. However, the typical small business does not have the resources nor the expertise to install integrated EDI software in their system. LMI reviewed 38 automated accounting systems and only found a few systems with EDI capabilities to either electronically receive purchase orders or electronically generate invoices [Ref.

15:p. 6-5]. This is not to say that there are no integrated systems available, but they are just very expensive.

c. EDI Knowledge Requirements

The last major concern is that many small businesses do not have the required knowledge base to operate EDI [Ref. 15:p. 6-2]. While this may be the case, it should not be an insurmountable problem. Approximately 68 percent of the respondents to a survey of small businesses stated that they "have basic knowledge/information about EDI technology" [Ref. 17:p. 3-14].

EDI training is currently available from many sources. Many VANs offer training to their customers. In addition, large trading partners will usually train their smaller trading partners as an incentive to implement EDI. DoD will have to offer the same type of training and education to their trading partners. Fortunately, there are more than 700 small business development centers (SBDC) and sub-centers scattered throughout the United States that can easily be prepared to conduct training in EDI to small businesses. [Ref. 15:p. 6-8]

G. EDI APPLICATIONS IN THE PRIVATE SECTOR

The possible benefits of implementing EDI, as discussed previously, demonstrate a sound business case for EDI. However, many companies and corporations are finding that EDI has potential for even greater advantages [Ref. 18:p. 138].

By establishing strong trading partner relationships based on trust and confidence, the buyers and sellers can work together as one company. Under such relationships, applications of EDI have expanded to include: electronic funds transfer (EFT)/financial EDI, just-in-time (JIT) inventorying, and evaluated receipts settlement (ERS).

1. Electronic Funds Transfer (EDT)/Financial EDI (FEDI)

One application of EDI that is currently used is the payment of invoices electronically. Two subsets of EDI are actually involved: Electronics Funds Transfer (EFT) and financial EDI (FEDI). Both involve a financial intermediary such as a bank, to allow financial value as well as information to be transferred from one trading partner to another. EFT is the bank-to-bank exchange of electronic payment instructions while FEDI is the exchange of electronic business information between an firm and its bank or other financial intermediary [Ref. 19:p.12]. Under EFT, there are four major electronic methods of moving funds between accounts in the banking system: FedWire, Automated Clearing House (ACH) transfers, Clearing House for Interbank Payment System (CHIPS), and Society for Worldwide Interbank Financial Telecommunications (SWIFT).

The information flow of a simple EFT-based transaction is shown in Figure 2.3. First, the supplier sends an invoice to the buyer notifying him that payment is expected (step a).

The buyer then instructs the bank to debit the buyer's account and credit the account of the supplier (step b). Bank one then debits the buyer's account and communicates the payment instructions to bank two who then credits the supplier's account (step c). Lastly, bank two notifies the supplier that the payment has been received (step d). The buyer may also send additional information to the seller notifying him of the reason for the payment (step e).

As EDI becomes more accepted in the business world, EFT/FEDI importance will surely increase. The banking industry must be ready to meet the challenge and expectations of their customers to remain competitive. One such initiative is the concept of value-added banks (VAB) in which banks begin to compete with VANs for non-financial as well as financial EDI transactions [Ref. 20:p. 32].

2. Just-in-Time (JIT) Inventorying

Over the last decade many inventory managers have begun using just-in-time (JIT) inventory systems in an effort to reduce or completely eliminate costly inventories. As the title suggests, raw materials are received just-in-time to go into production. To be effective, JIT requires that a company rely on only a few, very dependable suppliers who are bound by long term contracts. These suppliers must be willing to make more frequent, smaller deliveries in the exact quantities

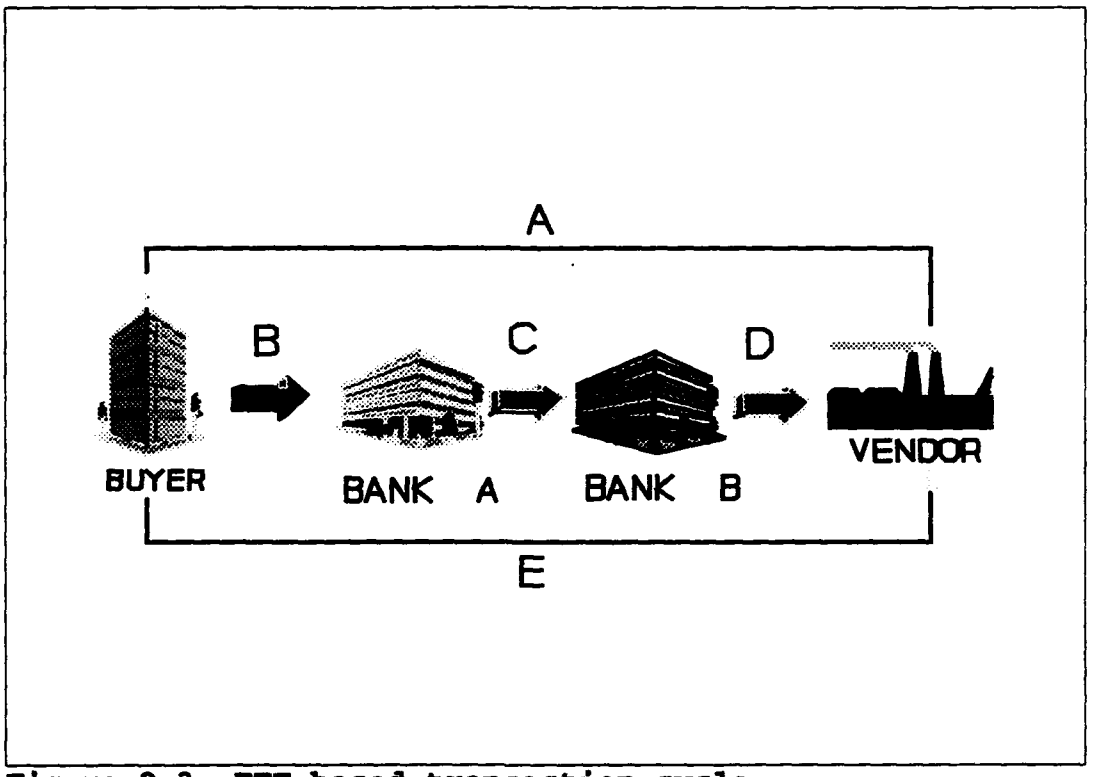

Figure 2.3 EFT-based transaction cycle
Source: Ferguson and Hill, "Introduction to EFT and Financial EDI," *EDI Forum*, v.5, n.3, p.18.

specified by the buyer. In addition, there must be constant and direct communication between the buyer and seller.

As effective as JIT is, it is extremely difficult to manage without highly coordinated supply channels. EDI is the key to perfecting JIT because it can provide the coordination and communication link that is so vital to the success of this inventory system. The buyer's computer can electronically notify the seller's computer when a delivery is required. The seller's computer can then automatically process the order and notify the buyer's computer of shipment status. This is all completed without human intervention with a maximum turnabout

of only a few hours. To assist the supplier in preparing for the order, the buyer can transmit advance planning and scheduling information with EDI.

With EDI/JIT, inventory reduction can significantly reduce operating costs. For example Navistar estimates it was able to reduce its inventory by 33 percent in only 18 months after implementing EDI/JIT for a savings of $167 million [Ref. 21]. Suppliers may also see a reduction in overhead costs. Chrysler estimates that each of its 1,300 suppliers will save 2,500 work hours by eliminating the manual processing of JIT orders [Ref. 21]. These savings alone appear to justify implementation of EDI/JIT. However, the potential for greater savings can be realized if EDI is matched with other automated technologies such as bar coding and hand held scanners that support transmission of X12 data. Such a match is currently supporting another EDI application - Evaluated Receipts Settlement.

3. Evaluated Receipts Settlement (ERS)

The last major EDI application is actually a combination of the previous two applications just discussed: JIT and EFT/FEDI. Evaluated Receipts Settlement (ERS) was first developed by the automobile industry as a payment method, without the use of invoices, between the automotive original equipment manufactures (OEMs) and their suppliers. Under ERS, the dollar amount of the payment is based on a

calculation of the quantity in the customer's receipt record multiplied by the price on the purchase order. Figure 2-4 shows the ERS flow of data, product, and funds.

Before the ERS can be used to facilitate the payment process, both trading partners must come to an agreement on pricing information and communicate this information so that the price files begin in synchronization.[2] The actual ERS payment process begins when the OEM places an order for a specific shipment of material. Step one is the typical flow of information and material described as follows:

a) First the OEM transmit release schedule via EDI to supplier requesting specific quantities of material.

b) The supplier then prepares material for shipment, prepares the associated paperwork, and loads material on the truck for delivery.

c) Next, the supplier records sale to OEM at the time material is shipped.

d) Lastly, the supplier transmits EDI shipping notice (ANSI 856) to OEM within 30 minutes after material has left the plant [Ref. 22:p. 37].

In step two, the OEM processes the shipping notice and receives the material. Relevant data from the shipping notice is validated and recorded in two different departments of the OEM. The Material Control Department validates the receipt records and is responsible for the following information:

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[2] Price changes must also be communicated by ANSI 860 (purchase order change) or ANSI 832 (price sales catalog). As of the summer of 1992, no major automotive OEMs are using EDI to communicate price changes resulting in less than optimal synchronizing of price changes.

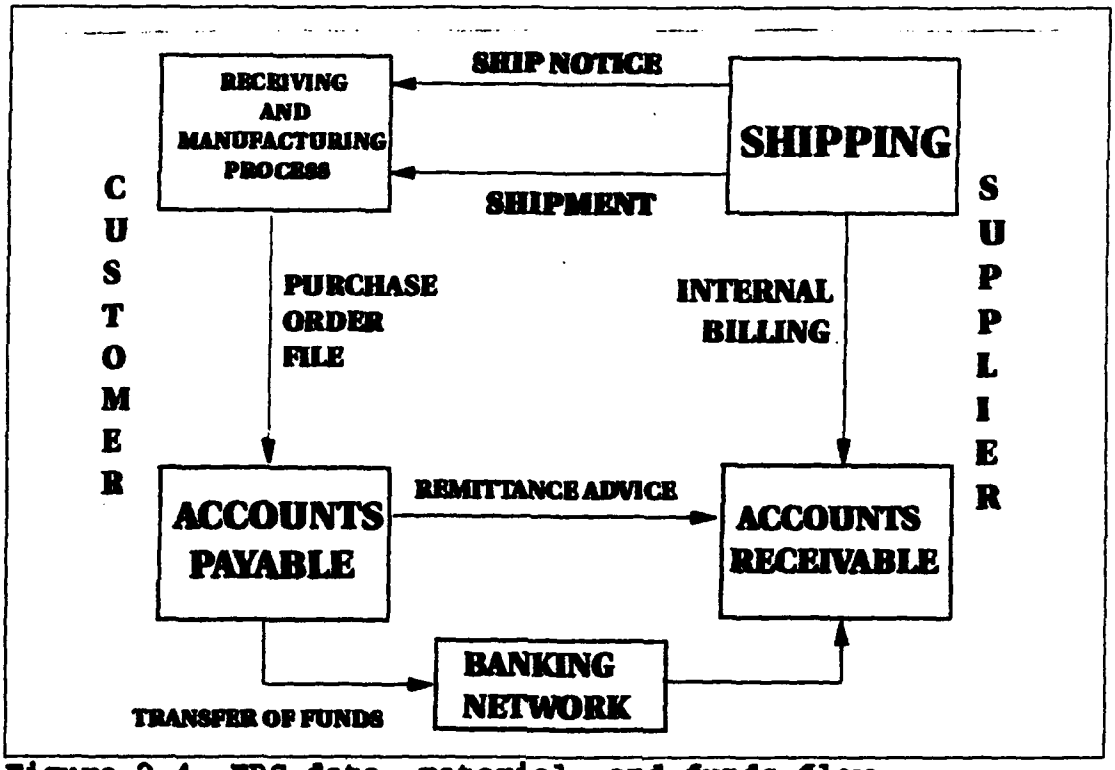

Figure 2.4 ERS data, material, and funds flow
Source: Schaap, Alexander, "Evaluated Receipts Settlement in the Automotive Industry," *EDI Forum*, v. 5, n.3, p. 36.

supplier, part number, unit of measure, and quantity received. The Purchasing Department maintains the required price data and is responsible for the following information: supplier, part number, unit of measure, and unit price. [Ref. 22:p. 37] The OEM's ERS system will then automatically match the data from the two departments with the information provided by the supplier in the shipping notice. The shipping notice contains the following information:

- Part number
- Quantity

- Shipment identification number (SID) - must be meaningful to supplier's ARS system and must identify shipment at time of receipt at OEM.
- Purchase order number (PO) - allows OEM to price shipment and pay upon terms of PO.
- Vendor identification - permits OEM to distinguish between suppliers that ship the same product [Ref. 22:p. 37].

Once the shipment arrives at the OEM, the following actions take place:

a) Receipt personnel will enter the SN in the computer and visually inspect the container received against the SN.

b) The receiving personnel then will enter a record of receipt in the computer showing the results of the inspection.

c) The OEM's ERS system posts a payable liability, due for payment at the required time.

d) An ANSI 861 (receiving advise) is transmitted to the supplier notifying them of the results of the receipt inspection [Ref. 22:p. 37].[3]

The last step in ERS involves the actual payment for the material. This step can be done electronically as with EFT/FEDI or by simply mailing a check to the supplier. Using the ANSI 820 (remittance advice), GM sends funds electronically to the supplier. Ford usually pays by paper check but will use the ANSI 820 if the suppliers are capable of receiving it.

ERS as proven very beneficial to the automobile OEMs. However, some tier-one and -two suppliers have not realize any

[3] Ford sends an ANSI 861 to the supplier for every shipment. Chrysler and GM only send an ANSI 861 if the inspection uncovers a discrepancy.

savings [Ref. 22:p. 39]. This is possible due to the lack of integration software. Just the same, studies show that a large segment of the automotive industry is today either using or planning on using ERS in the future [Ref. 22:p. 39]. The potential for similar payment systems in other industries and DoD have yet to be tested.

All three applications: EFT/FEDI, JIT, and ERS are depended upon very strong trading partner relationships. By working together, trading partners can work as one in a win-win situation. Nevertheless, EDI must be adopted by many more businesses and industries before the full potential can be achieved. As EDI use continues to develop, many more additional applications are surely to evolve.

H. CHAPTER SUMMARY

Electronic Data Interchange has slowly evolved from the original proprietary format of exchanging information from one computer to another between two trading partners in the same industry. Today, EDI is a process of electronically transferring routine business documents between one organization's computer to another in a pre-established, standard format that can cross industry lines. Although, impediments to implementation of EDI still exist, most are being resolved as the use of EDI continues to expand. The benefits and applications of EDI should continue to develop as experience in EDI is gained.

In the next chapter, the survey conducted for this research will be examined and the results will be presented.

III. ELECTRONIC DATA INTERCHANGE INDUSTRY SURVEY RESULTS

A. INTRODUCTION

The primary objective of this research is to ascertain how private industry is utilizing EDI in the procurement/ acquisition environment and what problems have been encountered during its implementation and operation. This chapter presents the data and responses collected from a survey of EDI users in various sectors of private industry.

B. SURVEY DEVELOPMENT

A survey was developed as the primary means of gathering information concerning EDI in private industry. Structured, short-answer type questions were used to determine where the respondents were in the implementation of EDI. More specifically, the survey sought to determine how EDI is used in the areas of procurement and acquisition/contracting. Additionally, open-ended questions were used to explore common problems associated with EDI and to discover any new or innovative applications of EDI.

The survey was divided into four sections. The first section dealt with the background information of organizations responding. The second section was concerned with what transaction sets (associated with procurement and contracting) were being used by the respondent's organization. Information

pertaining to the implementation of EDI was the focus of the third section. And the last section was devoted to questions dealing with the actual operation of EDI within the organization. The survey and cover letter is presented in Appendix one.

C. SURVEY RESULTS

The survey was mailed out to 425 members of DISA. DISA was chosen because of its diverse membership of organizations engaged in manufacturing, transportation, research, trading, educational, and government activities. Additionally, most of DISA's members are involved in some aspect of EDI. Of the 425 surveys mailed out, 95 positive responses and 14 negative responses were received. Most of the negative responses stated non-applicability as the reason for not completing the survey.

The remainder of this section is divided into the four subsections which address each part of the survey as follows: (1) background information, (2) transaction set information, (3) EDI implementation, and (4) EDI operation. Results of the survey are presented by question under the corresponding subsection.

1. Background Information

The questions under this section of the survey

were asked to ascertain the size of the organization, what standards and implementation quidelines are being used by the organization and how involved the organization is in EDI.

Question 1: Is your organization designated as a "small business?"

Small business, in this content, is defined by the Department of commerce as a business " that, including its affiliates, is independently owned and operated, and not

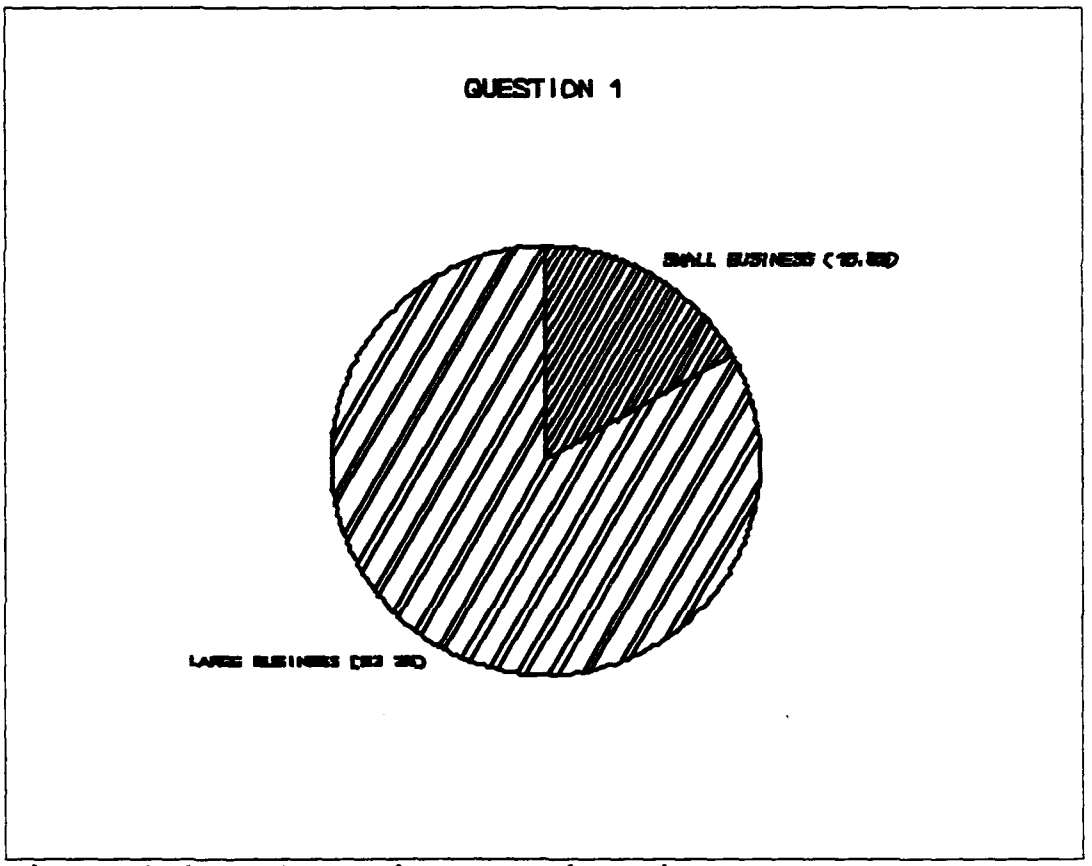

Figure 3.1 Small Business Designation

dominant in the field in which it is bidding on Government contracts" [Ref. 23:p. 47]. Figure 3.1 presents the response to question one.

Question 2: What was your organization's total sales for fiscal year 1992?

Only 83 responded to this question. An average sales figure would be meaningless but the sales varied from 0 to $35 billion.

Question 3: What EDI standards are you currently using?

The choices provided to choose from were the ANSI X12 standards, the EDIFACT standards, and other standards. Of the three, ANSI X12 standards were by far the most popular choice with 90 percent of the respondents reporting using this standard. Other standards (proprietary) came in second with 30 percent of the respondents using some form of proprietary standards. And 20 percent of the respondents reported using EDIFACT standards. Figure 3.2 presents the responses to question three.

Question 4: Are you planning to change to ANSI X12 standards within the next five years?

This question was only answered by those respondents that were not currently using the ANSI/X12 standards. Five of

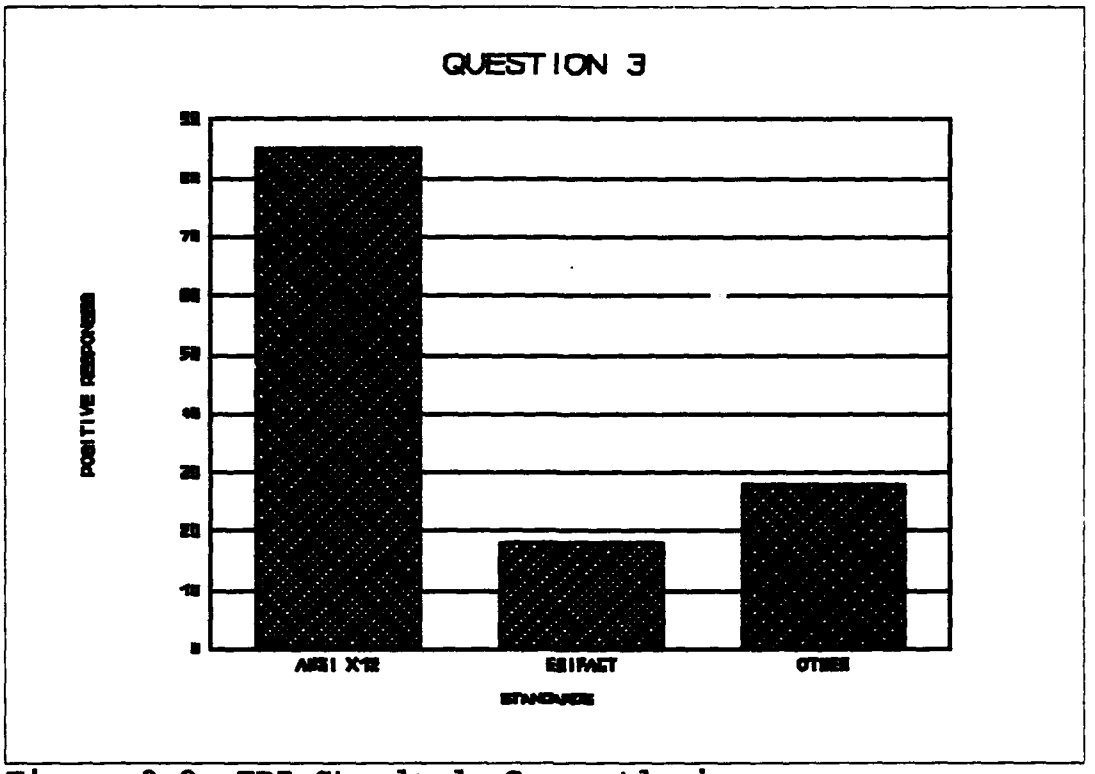

Figure 3.2 EDI Standards Currently in use

the ten respondents (50 percent) not currently using X12 standards are planning to implement or change to the X12 standards within the five year time frame.

Question 5: Are you planning to change to UN/EDIFACT standards within the next five years?

This question was only answered by those respondents that were not currently using the UN/EDIFACT standards. 30 of the 77 respondents (39 percent) not currently using EDIFACT standards are planning to implement or change to EDIFACT standards within the five year time frame. Many of the

negative respondents stated that they would only implement EDIFACT standards if required by their customers.

Question 6: What implementation guidelines are you using?

The respondents were asked to pick, from a list of eleven major guidelines, the implementation guidelines which they subscribe to. More than one guideline could be chosen. In addition, there was also a choice for other guidelines or none at all. The eleven major guidelines are as follows:

- AIAG (Automotive Industry Action Group)
- AIA (Aerospace Industry Association)
- CIDX (Chemical Industry Data Exchange)
- EDIA/TDCC (EDI Assoc./Transportation Data Coordination Comm.)
- EDX (Electrical Industry Data Exchange)
- EIDX (Electronic Industry Data Exchange)
- PIDX (Petroleum Industry Data Exchange)
- TMA (Treasury Management Association)
- VICS (Voluntary Interindustry Communication Standard)
- Utility Industry Group
- WINS (Warehouse Industry Standard)

No one implementation guideline really stood out in front of the crowd. The "other" category had the most responses with 40 percent. All categories were marked with at least 5 respondents and the "none" category had 21 responses.

Figure 3.3 shows the distribution of responses to question six.

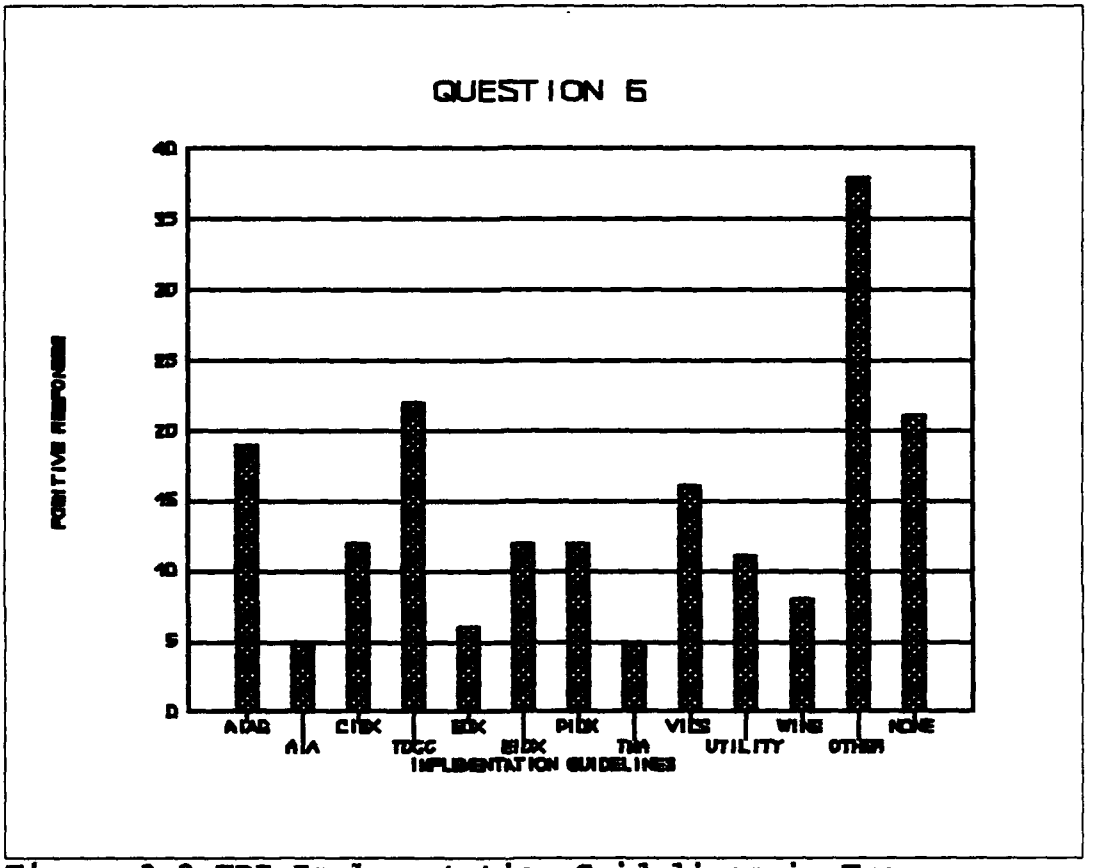

Figure 3.3 EDI Implementation Guidelines in Use

Question 7: How many trading partners do you have?

This question was asked to get a general feel for average number of trading partners the respondents to this survey have. The average number of trading partners was 356.

However, the number of trading partners reported ranged from none on the low end to over 7000 on the high end. These figures should not be used to make any statistical inferences concerning the number of trading partners of organizations throughout the United States, but simply to give a better image of the respondents of this survey.

Question 8: How many EDI transactions do you receive each month?

The respondent's answers were grouped into five categories as follows: less than 100 transactions per month (TPM), between 100 and 1000 TPM, between 1000 and 10,000 TPM, between 10,000 and 100,000 TPM and greater than 100,000 TPM. Of the five categories, 29 percent fell in the range from 10,000 to 100,000. This is not surprising since this by far is the greatest range. Only 16 percent of the respondents received less than 100 transactions per month. 21 percent of the respondents received between 100 and 1000 TPM. 19 percent of the respondents received between 1000 and 10,000 TPM. And 15 percent received greater than 100,000 TPM. Figure 3.4 show the distribution of responses to question eight.

Question 9: How many EDI transactions do you send out each month?

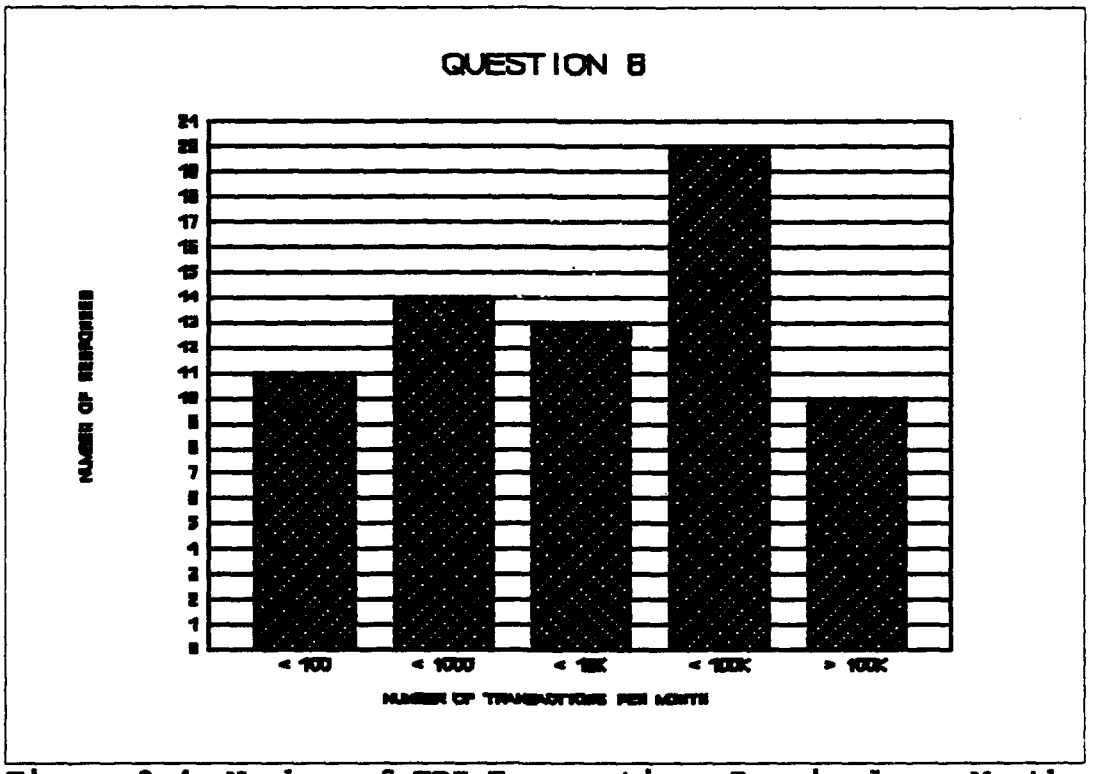

Figure 3.4 Number of EDI Transactions Received per Month.

The responses were grouped into the same five categories as in question eight. This time the largest categories of responses was in the range between 1000 and 10,000 TPM with 27 percent of respondents reporting to send out EDI transactions numbering within this range. 15 percent of the respondents sent out less than 100 TPM. 23 percent of the respondents sent out between 100 and 1000 TPM. 20 percent of the respondents sent out between 10,000 and 100,000. And 14 percent sent out over 100,000 TPM. Figure 3.5 shows the distribution of responses to question nine.

Question nine was the final question under the background information section of the survey. The next

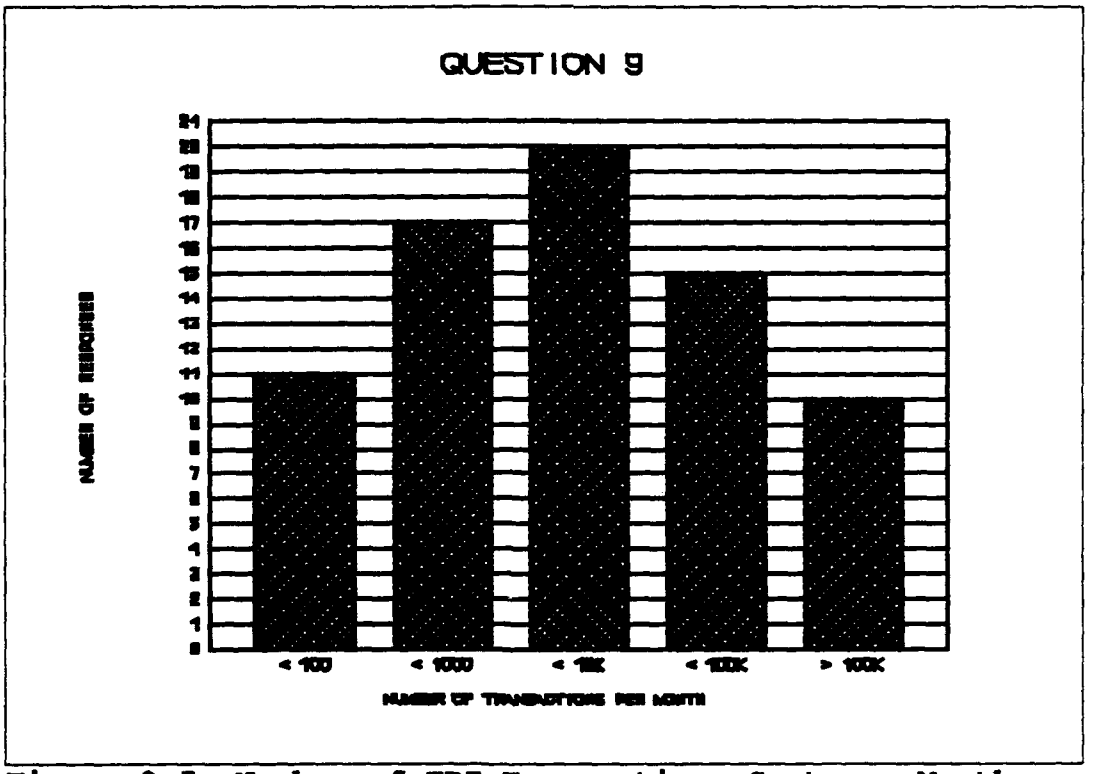

Figure 3.5 Number of EDI Transactions Sent per Month

section of the survey is transaction set information which will be covered next.

2. Transaction Set Information

Only one question is asked under this section. However, the question is broken down into 46 separate parts. The intent of this section was to determine what types of procurement or acquisition/contracting related transaction sets are being used in industry.

Question 10: Do you send/receive the following ANSI/X12 transaction set(s) to/from your trading partners?

This question refers to 23 different ANSI X12 transaction sets listed in Table 2. The respondents were asked if they are sending or in the process of developing the capablity to send each of the 23 transaction sets. In addition, the respondent were asked if they are receiving or are in the process of developing the capability to receive each of the 23 transaction sets. Figures 3.6 thru 3.11 presents the distribution of responses to question ten.

TABLE 2
ANSI X12 TRANSACTION SETS

a. 511 - Requisition
b. 810 - Invoice
c. 820 - Payment Order/Remittance Advice
d. 830 - Planning Schedule
e. 832 - Price Sales Catalog
f. 836 - Contract Award
g. 838 - Trading Partner Profile
h. 840 - Request for Quotation
i. 841 - Specification/Technical Information
j. 843 - Response to RFQ
k. 846 - Inventory Inquiry
l. 850 - Purchase Order
m. 855 - Purchase Order Acknowledgement
n. 856 - Ship Notice/Manifest
o. 858 - Shipment Information
p. 860 - Purchase Order Change
q. 861 - Receiving Advice
r. 862 - Shipping Schedule
s. 863 - Report of Test Results
t. 865 - Purchase Order Change Acknowledgement
u. 869 - Order Status Inquiry
v. 870 - Order Status Report
w. 997 - Functional Acknowledgement

SOURCE: All tables were developed by the researcher unless otherwise noted.

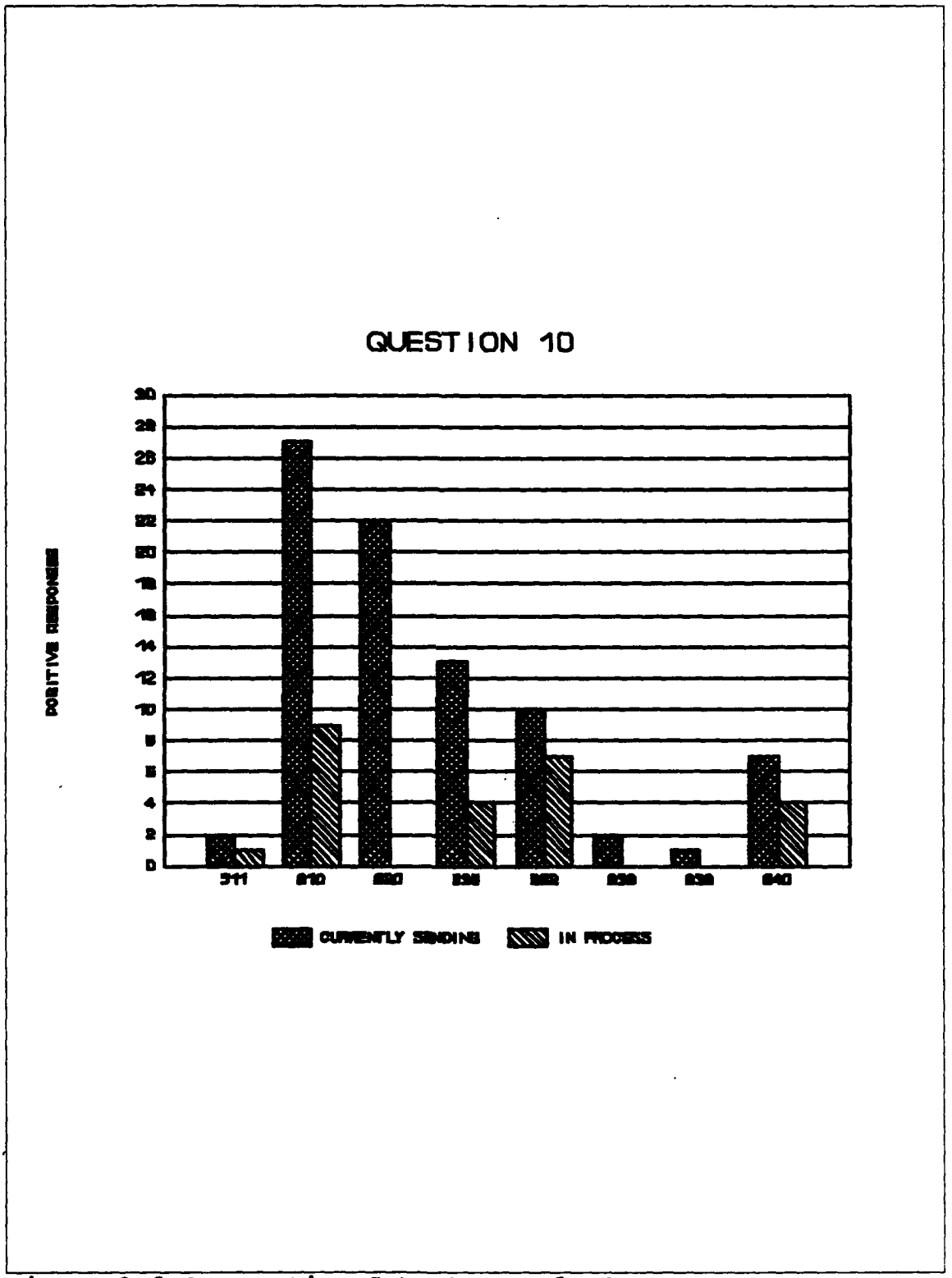

Figure 3.6 Transaction Sets Currently Sent

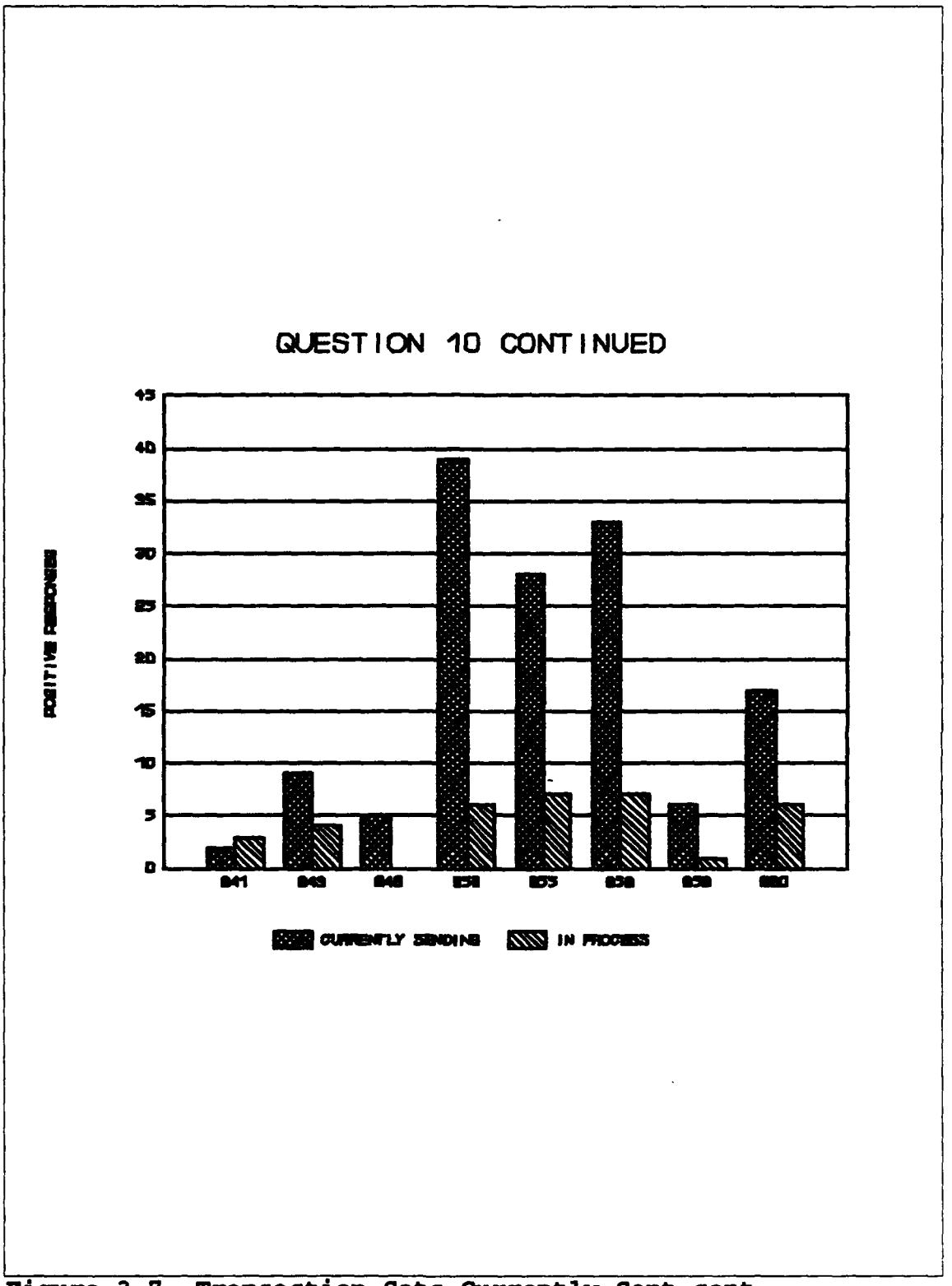

Figure 3.7 Transaction Sets Currently Sent cont.

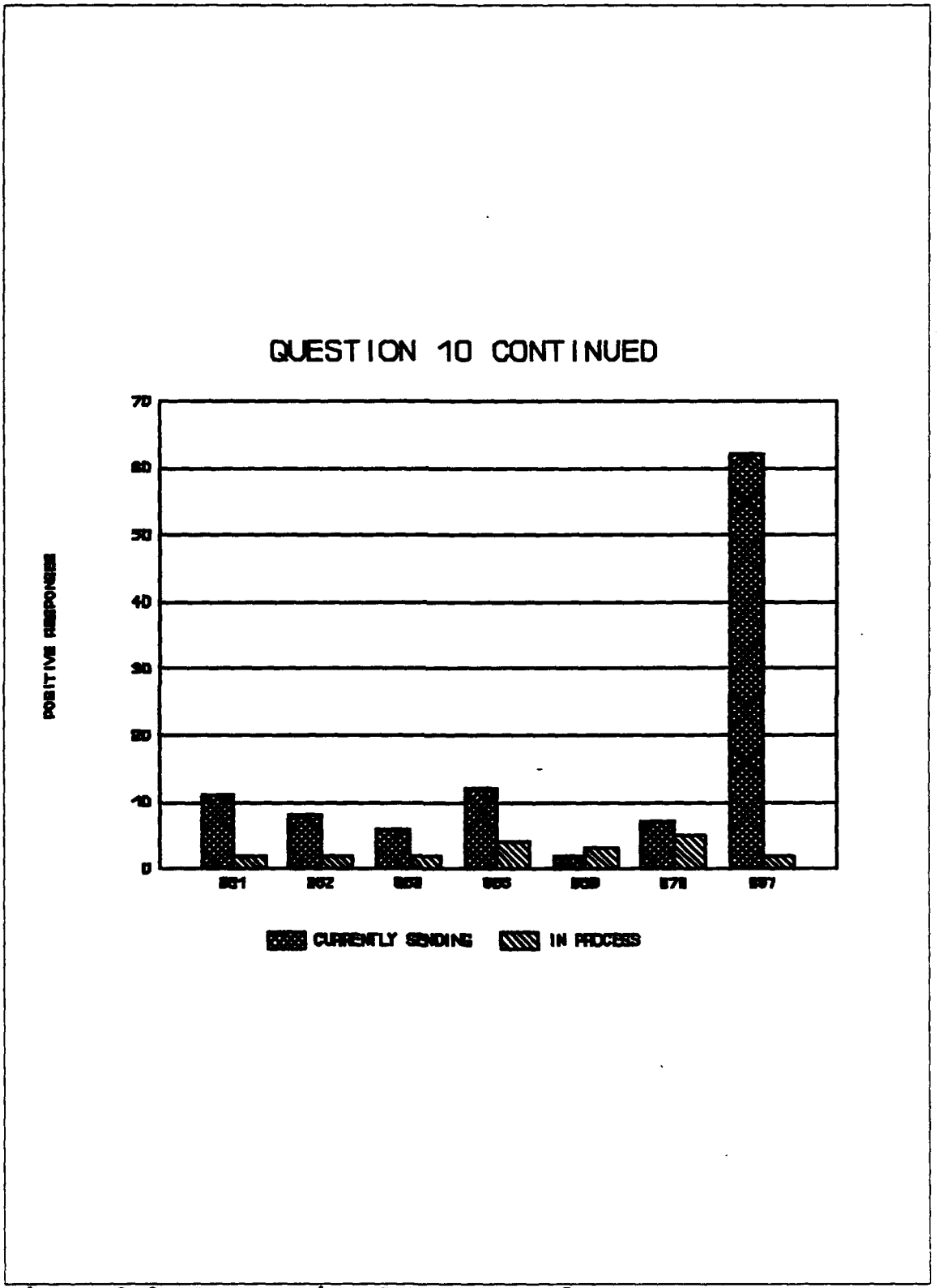

Figure 3.8 Transaction Sets Currently Sent cont.

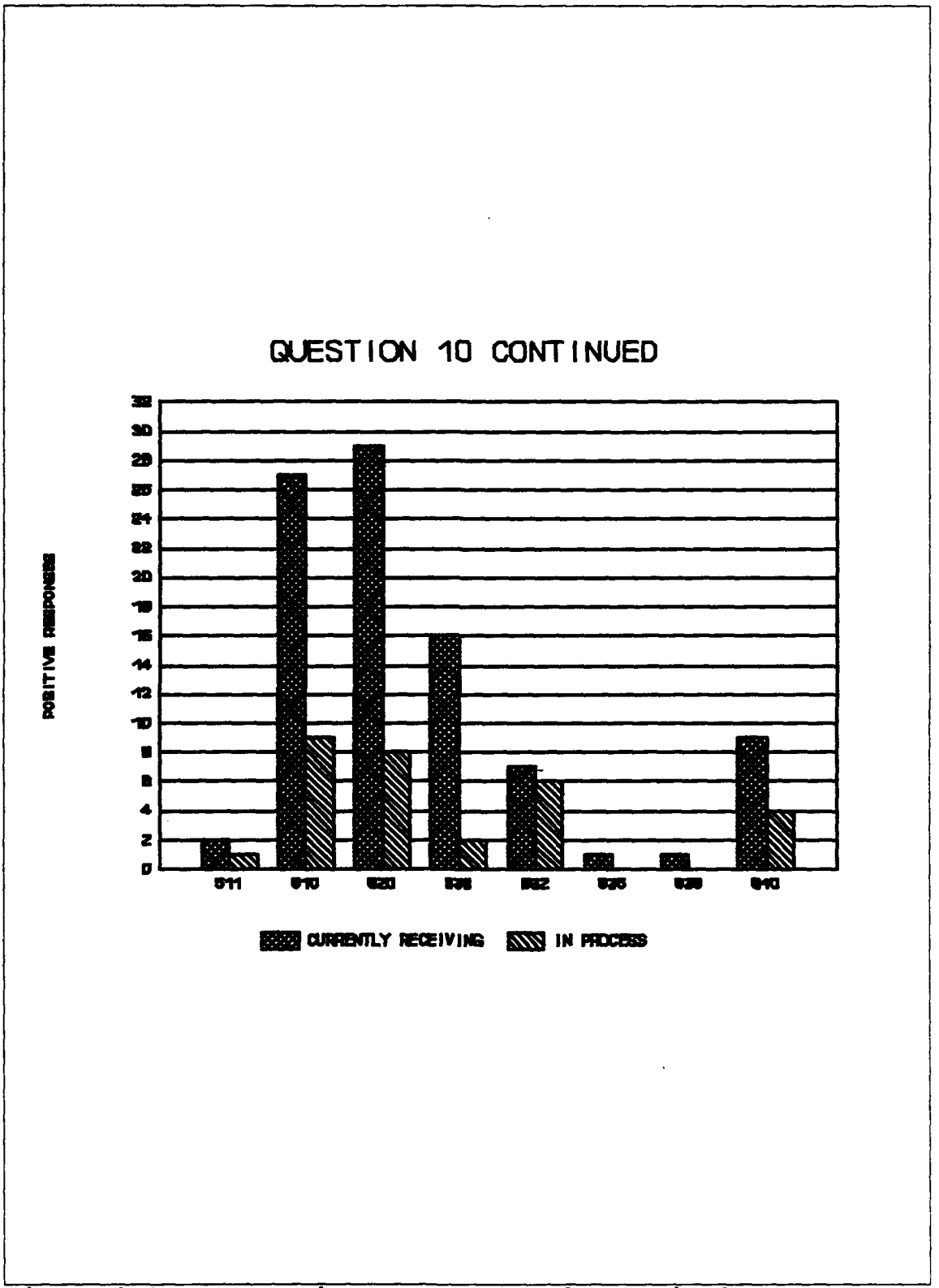

Figure 3.9 Transaction Sets Currently Received

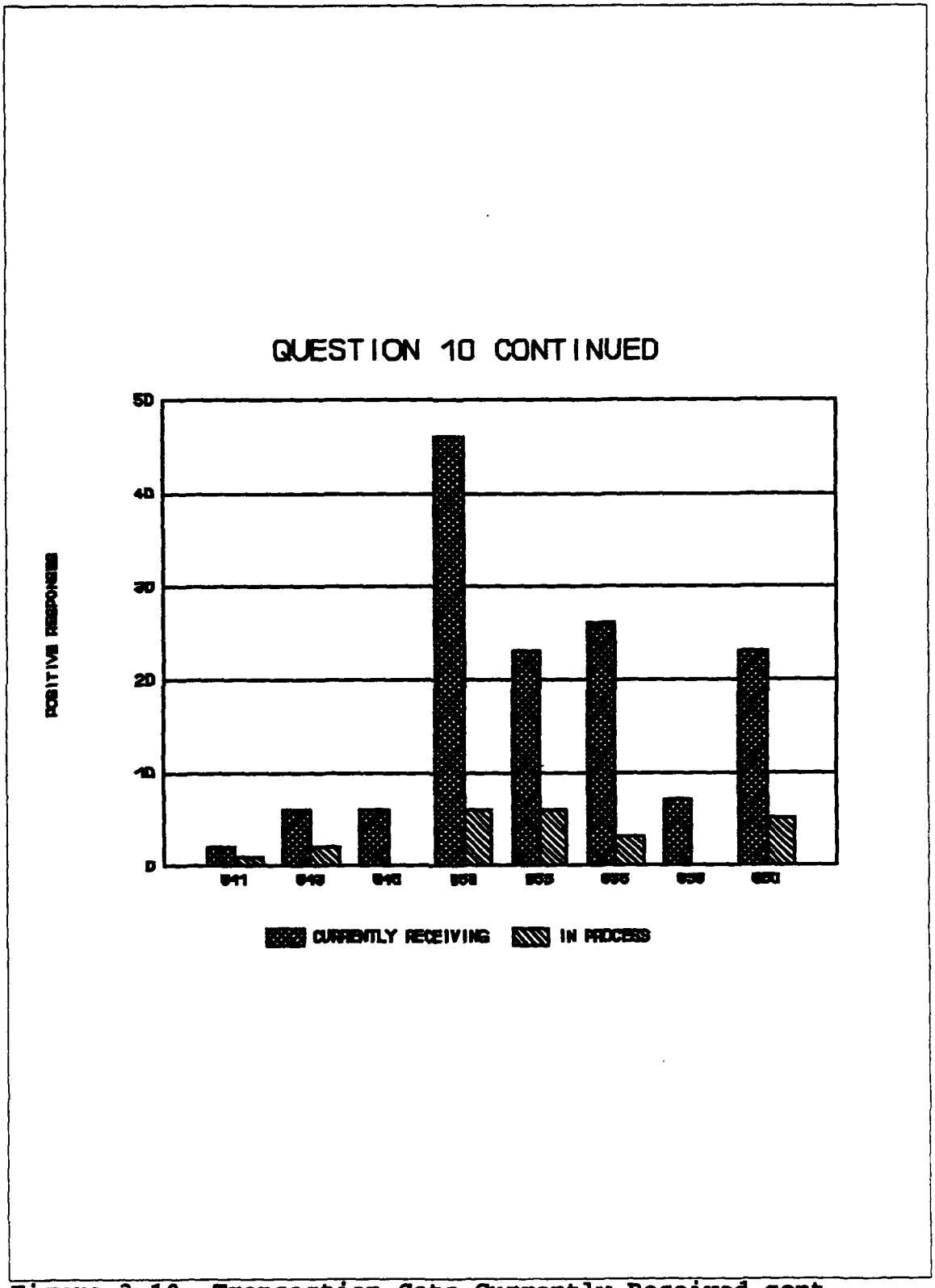

Figure 3.10 Transaction Sets Currently Received cont.

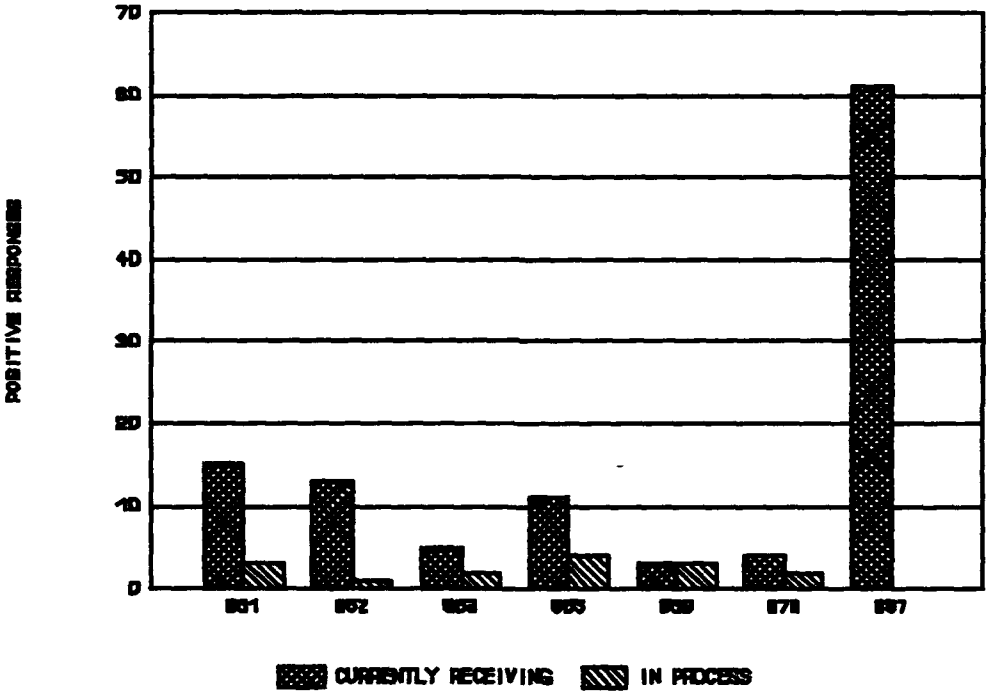

Figure 3.11 Transaction Sets currently Received cont.

3. EDI Implementation

Questions 11 through 18 were listed under the EDI implementation section of the survey. These questions were designed to find out what would be the affect on businesses, both large and small, if DoD required EDI as a prerequisite for doing business. In addition, it was hoped that this section would shed some light on how EDI software is being used in private industry. Most of the questions required only short yes or no responses; therefore, graphs will be omitted for most questions.

Question 11: Was EDI forced upon you as a condition for continuing to do business with a trading partner?

A positive response was received by 38 percent of the respondents. While clearly not a majority, it appears that EDI implementation was forced on many of the companies surveyed.

Question 12: Have you required your vendors/suppliers to implement EDI as a condition for continuing to do business with you?

Nearly 18 percent of the respondents have required their trading partners to implement EDI. However, this figure

is expected to increase as EDI becomes more accepted in business.

Question 13: Is there strong support for EDI from top level management within your organization?

Of the 95 respondents who answered this question, a total of 80 (85 percent) responded favorably. This is not surprising considering the amount of change required within an organization to fully implement EDI.

Question 14: Did you develop a strategic plan for EDI prior to implementation of EDI?

A full 49 percent responded that a strategic plan was developed before EDI was implemented in their organization. This obviously means that over half of the respondents implemented EDI without fully understanding how they were going to fully utilized it.

Question 15: What was the total cost of EDI implementation within your organization?

The total cost figure included: the cost of additional hardware to support EDI, the cost of EDI software (off-the-shelf or in-house development), and the cost of EDI training

throughout the organization. Responses to this question were grouped into five categories as follows: less than $1500, less than $3000, less than $10,000, less than $30,000, and greater than $30,000. Over 75 percent of the respondents reported that the cost of implementing EDI was in excess of $30,000. Figure 3.12 shows the distribution of responses to question 15.

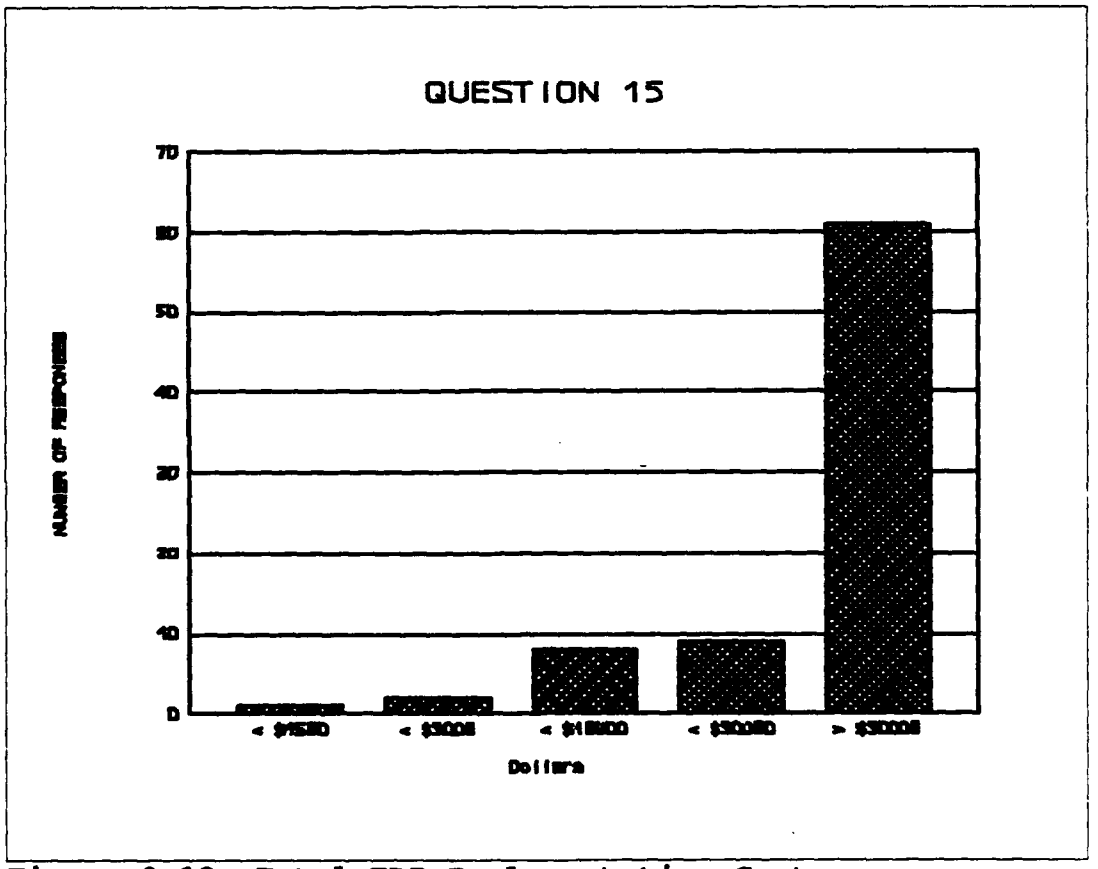

Figure 3.12 Total EDI Implementation Costs

Question 16: Did you purchase a commercial off-the-shelf software package?

This question was asked to determine how many of the respondents were purchasing EDI software packages and how many were developing EDI software in-house. Over 64 percent of the respondents have purchased off-the-shelf software packages. The remaining 36 percent must have developed a in-house software program.

Question 17: Is your EDI software integrated with your in-house management information system?

This question was asked to find out how many of the respondents do not have to re-key incoming EDI transactions to complete the tasks. If re-keying was necessary then their software was not integrated. Over 75 percent of the respondents reported that their EDI software was integrated with their management information system.

Question 18: What functional areas capabilities within your organization have integrated with EDI?

This question was designed to give DoD some idea of how industry is using EDI within their organizational

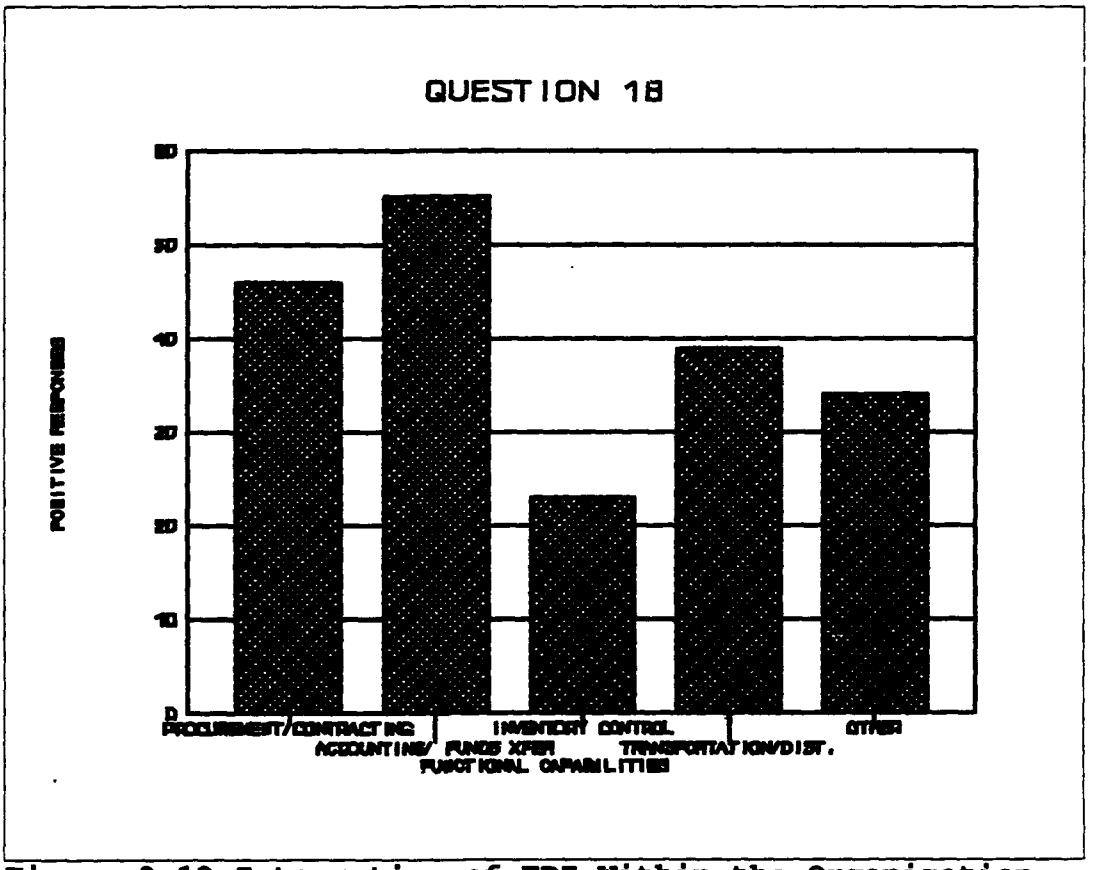

Figure 3.13 Integration of EDI Within the Organization

structure. The question included five functional areas from which the respondent could choose: procurement /contracting, accounting/funds transfer, inventory control, transportation /distribution, and other areas. EDI was integrated with the accounting/funds transfer capabilities of 58 percent of the organizations responding. The Procurement/contracting capabilities were integrated with EDI in 48 percent of the organizations. Transportation and distribution was integrated in 41 percent of the organizations and inventory control in 24 percent of the organizations. In addition, 36 percent of the

organizations reported that EDI was integrated with other functional capabilities. Figure 3.13 show the distribution of responses to question 18.

4. EDI Operation

In this, the last section of the survey, the questions address how private organizations are handling the authentication, integrity, and security issues of EDI. In addition, this section contains several open ended questions concerning problems encountered during EDI implementation and operation. If these problems have been solved, the solutions will also be presented. The last question asks for any innovative purchasing and acquisitioning applications of EDI used by the respondent. Designed to provide DoD with lessons learned from private industry in EDI, this section should prove helpful to DoD as it moves toward full implementation of EDI in the procurement and acquisitioning/contracting environments.

Question 19: Do you utilize Value Added Network (VAN) services?

This question was asked to determine how prevalent the use of VAN services are in private industry. Almost 88 percent of the respondents reported using VAN services to some extent.

Question 20: How do you ensure that EDI messages are authentic?

The respondents to this question could choose from any of the following three answers: Rely on VAN services for authentication, use your own authentication scheme, or do not require authentication. The replies were very evenly matched as indicated by Figure 3.14.

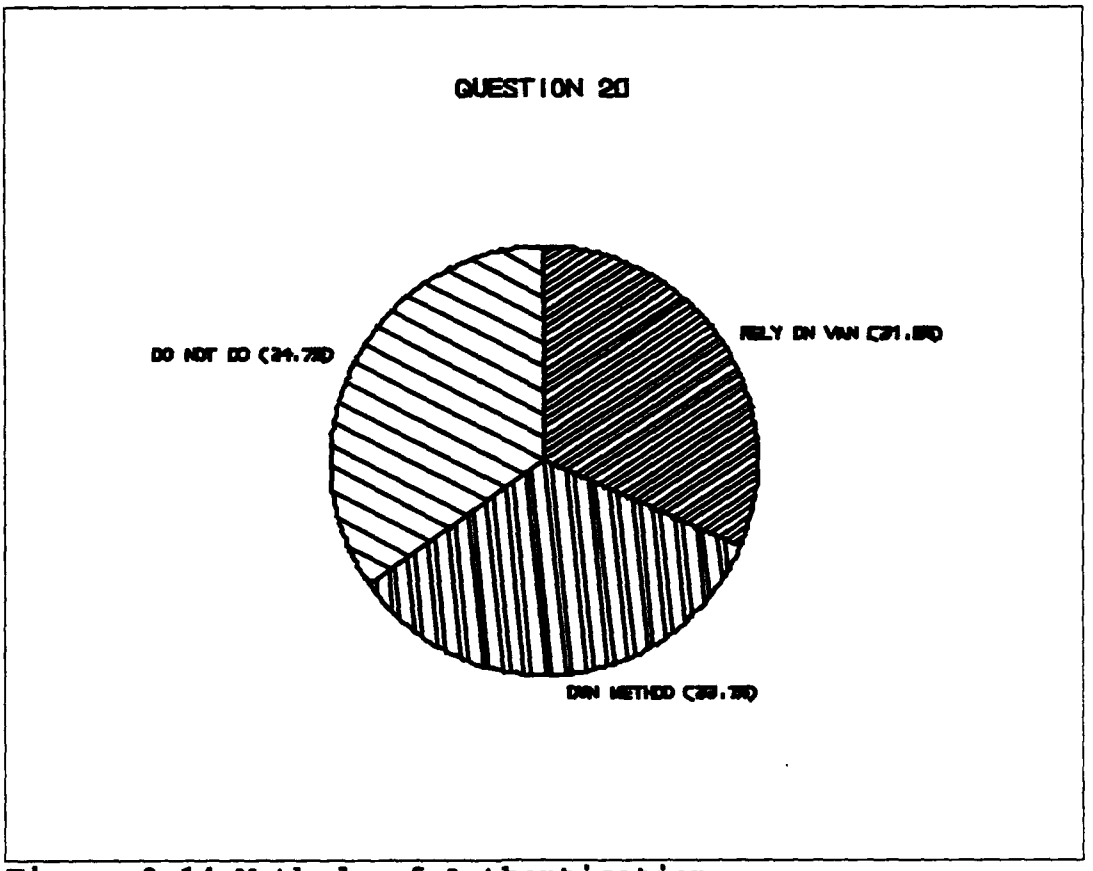

Figure 3.14 Methods of Authentication

Question 21: How do you assure the integrity of EDI messages?

Like question 20, this question offered three replies as follows: rely on VAN services, use your own integrity assurance scheme, and do not assure integrity. A majority of the respondents reported that they ensure their own EDI integrity. The breakdown of responses to question 21 is shown in Figure 3.15.

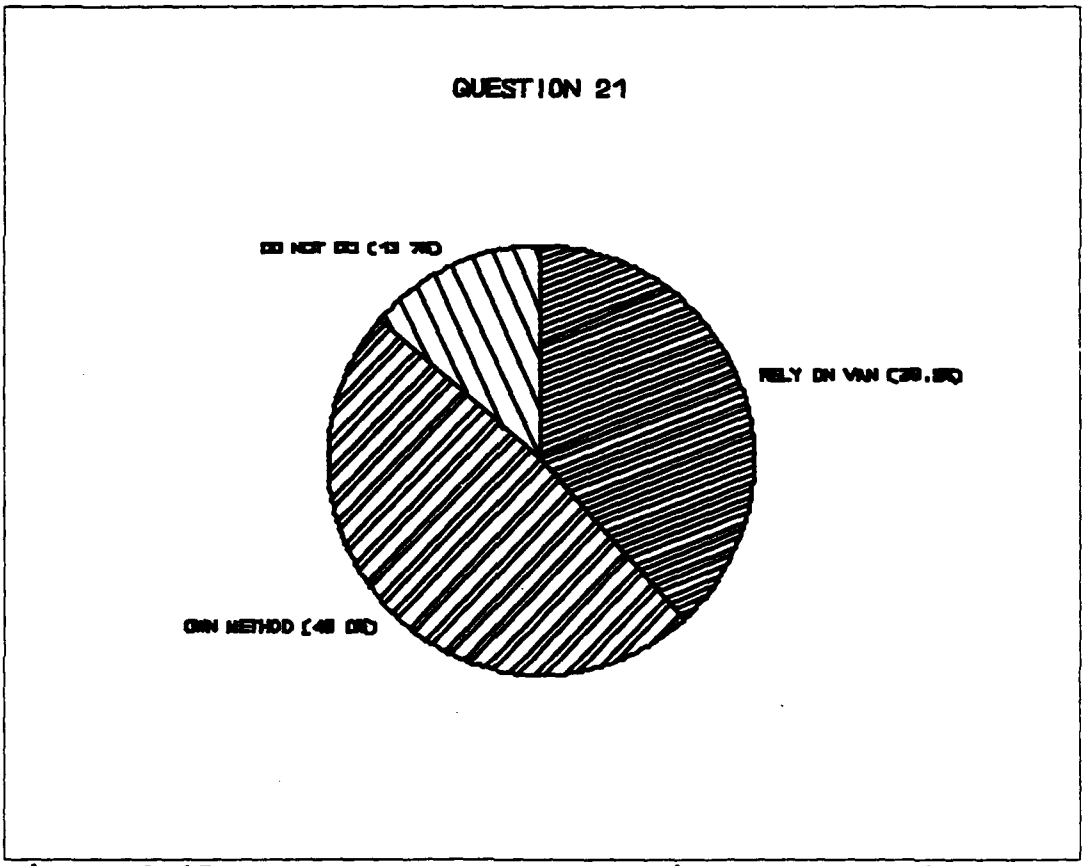

Figure 3.15 How EDI Message Integrity Is Ensured

Question 22: If your own authentication or integrity scheme is used, is it Public Key Encryption (PKE)?

This question was asked to determine if PKE is being used in private industry. The responses to this question were yes, no, or do not know. As Figure 3.16 shows, PKE is clearly not being used to any noticeable extent.

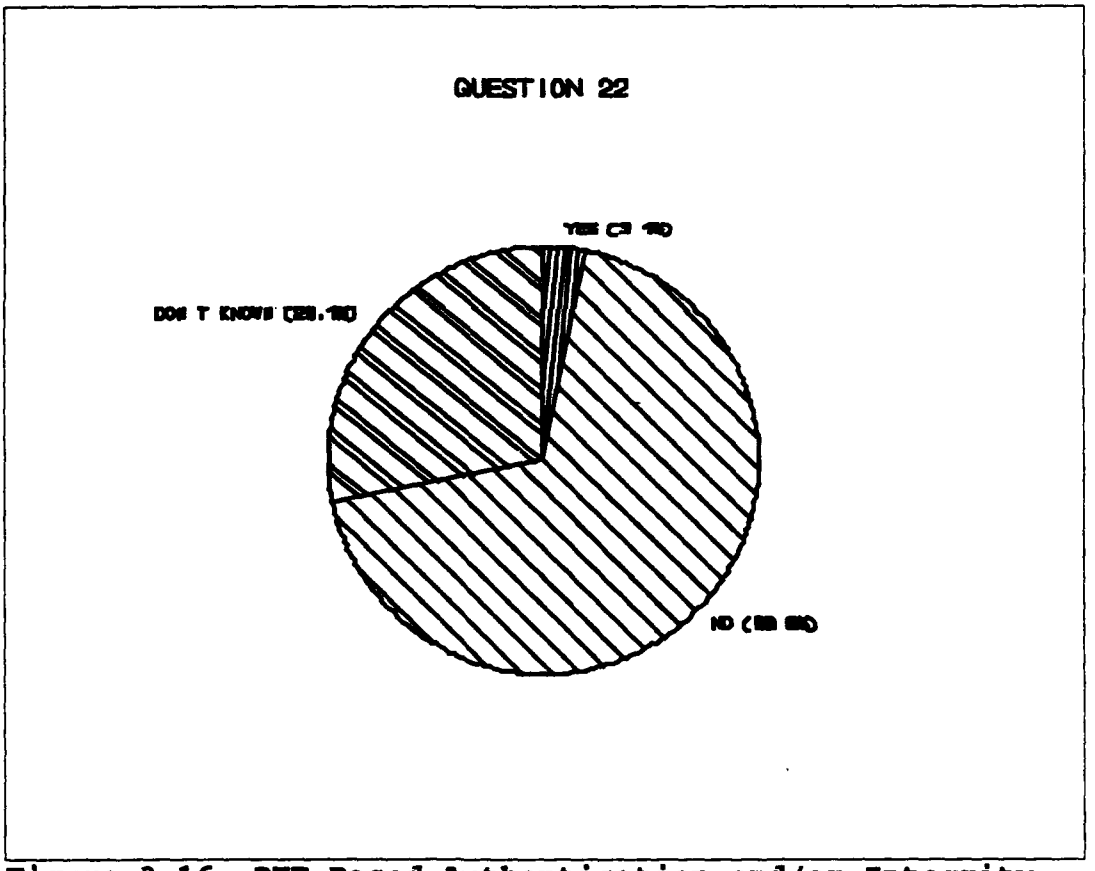

Figure 3.16 PKE Based Authentication and/or Integrity

Question 23: How do you protect sensitive or classified EDI information?

This question included four replies as follows: rely on VAN services for protection, use your own encryption mechanism, do not currently protect sensitive/classified EDI information, or other means. Figure 3.17 shows that a majority of the respondents either relied on a VAN for protection or simply do not currently protect sensitive /classified EDI information.

Question 24: Do you have the capability to create comprehensive audit trails of EDI transactions?

This question was asked to determine if private industry is concerned with and able to audit EDI transactions. Over 87 percent of the respondents reported possessing the ability to create comprehensive EDI audit trails.

Question 25: What problems did you encounter during the implementation of EDI?

Question 26: How did you solve these implementation problems?

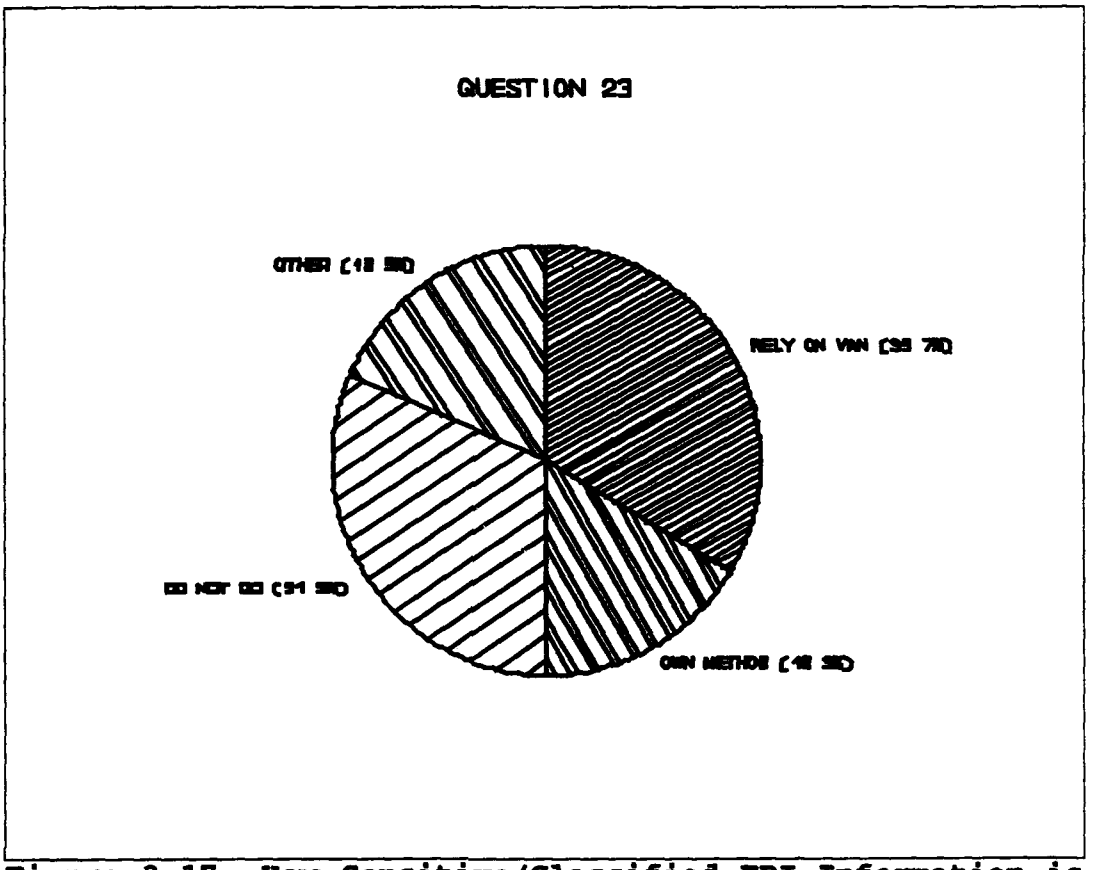

Figure 3.17 How Sensitive/Classified EDI Information is Protected

There were many one of a kind answers to these two questions. However, several prominent problems and solutions were brought up again and again. The problems included: a lack of knowledge and understanding of EDI, a lack of upper management support for EDI, a lack of EDI integration with existing applications and information systems, and difficulties with commercial EDI software packages.

The most common solutions to these problems were organizational training and education on EDI, establishment of EDI steering groups, conducting cost/benefit analysis of EDI,

redesigning application systems, and trail and error. The next two questions concern problems encountered during EDI operation.

Question 27: What problems have you encountered since implementing EDI?

Question 28: Have these problems been solved? If so, how?

There were, again, many one time answers to questions 27 and 28. Nonetheless, several problems and solutions appeared to be highlighted on a majority of the surveys. The problems most often mentioned were a lack of EDI standards among different trading partners, continued difficulties with EDI integration, inability to attract EDI trading partners, and data integrity challenges. Solutions to these problems included: supporting and encouraging the use of ANSI X12 and/or EDIFACT standards, maintaining constant communications with trading partners, conducting EDI seminars for suppliers and vendors, and maintaining audit trails of all transactions. The last question addresses current application of EDI in the procurement areas of private industry.

Question 29: What principal purchasing and acquisition applications have resulted from EDI implementation?

This question was asked in hopes to uncover new and innovative applications of EDI within the purchasing and acquisition/contracting areas. However, the survey failed to reveal any applications other than those already reported in chapter two. For instance, many of the respondents were either incorporating or in the process of incorporating EDI with just-in-time (JIT) inventorying or in the process of doing so. Evaluated Receipts Settlement (ERS) was also widely used by the respondents. In addition, electronic Funds Transfer (EFT) and bar coding applications was reported to be used by some of the respondents.

D. SUMMARY

Data from the survey of private industry was divided up into four sections: background information, transaction sets, EDI implementation, and EDI operation. Results were presented by question under the corresponding section. The following chapter will analyze the data presented in Chapter III.

IV. DATA ANALYSIS

A. INTRODUCTION

The purpose of this chapter is to provide an analysis of the data presented in Chapter III. The focus of this analysis will be on the four sections of the survey. The subsidiary research questions that have not been answered in previous chapters will also be addressed as they apply to the survey. Each section of the survey will be analyzed separately in the following order: background information of survey respondents, transaction sets currently used by industry in the procurement environment, EDI implementation issues, EDI implementation problems and solutions, EDI operation issues, and EDI operational problems and solutions. A chapter summary will be provided at the end of this chapter.

B. SURVEY RESPONDENTS BACKGROUND INFORMATION

The first section of the survey was designed to give a general overview of the EDI background of the survey respondents. Since the survey was only mailed to members of DISA, it can be assumed that all companies responding were at least aware of EDI and currently involved in EDI to some extent. In addition, most of the companies responding were classified as large businesses. This should not be surprising

since many small businesses still lack technical knowledge of EDI unless their larger trading partners are using EDI.

Table 3 presents a comparison between the average number of trading partners that small businesses surveyed reported having and the number of trading partners reported by large businesses. The average numbers presented show that large businesses have considerably more trading partners than small businesses. However, due to the extremely large standard deviations for both small and large businesses, these averages should not be used to support any statistical inferences concerning the average number of trading partners for businesses large or small.

TABLE 3

AVERAGE NUMBER OF TRADING PARTNERS

	MEAN	STANDARD DEVIATION
SMALL BUSINESS	107	250
LARGE BUSINESS	404	1044
SMALL AND LARGE	356	968

SOURCE: All tables were developed by the researcher unless otherwise noted.

The survey showed that 95 percent of the responding companies were either using ANSI X12 standards or are planning to use ANSI X12 standards within the next five years. Again, this is not surprising since all were DISA members. However, 30 percent of the companies are still using other proprietary

standards. If EDI is going to be successful, companies need to phase out use of proprietary standards as soon as possible. The use of UN/EDIFACT standards is still not widely used; but, its use should continue to increase. This is particularly true since X12 standards is due to align with EDIFACT in 1994 [Ref. 6:p. 5].

As industries continue to implement X12 and EDIFACT standards, they need to ensure that their implementation guidelines do not reflect too many industry specific conventions. If industry implementation guidelines continue to require industry specific conventions to be included as mediatory elements of transactions sets, then the standards will not serve the purpose as they were intended. The problem of industry implementation guidelines is magnified by the number of guidelines currently in use. The responding companies subscribed equally to many different guidelines. With so many guidelines present, the small Mom and Pop businesses are hard pressed to meet the conventions of trading partners from several different industries.

The responding companies conducted a wide range of EDI business transactions per month. The number of transactions sent and received each month were fairly evenly distributed in the five categories presented. However, when the data is divided up into small and large businesses (see Tables 4 and 5), a much larger percentage of small business are handling less than 10,000 transactions while a majority of the large

businesses are handling greater than 10,000 transactions. In addition, Table 6 shows a positive correlation between the number of transactions a business is able to send and receive.

TABLE 4

NUMBER OF TRANSACTIONS SENT PER MONTH

	SMALL BUSINESS	LARGE BUSINESS
LESS THAN 100	33%	11%
LESS THAN 1000	25%	23%
LESS THAN 10,000	25%	28%
LESS THAN 100,000	17%	21%
GREATER THAN 100,000	0%	16%

TABLE 5

NUMBER OF TRANSACTIONS RECEIVED PER MONTH

	SMALL BUSINESS	LARGE BUSINESS
LESS THAN 100	33%	12%
LESS THAN 1000	25%	20%
LESS THAN 10,000	25%	18%
LESS THAN 100,000	17%	32%
GREATER THAN 100,000	0%	18%

TABLE 6

COMPARISON OF TRANSACTIONS SENT AND RECEIVED

	<100	<1000	<10,000	<100,000	>100,000
<100	31	4	2	1	0
<1000	1	12	1	0	0
<10,000	0	1	11	0	1
<100,000	1	0	6	13	0
>100,000	0	0	0	1	9

The number of trading partners each company had also varied from one survey to another as noted in Table 3. With such a wide range of EDI business activity, the responding companies' answers to the remaining survey questions should be representative of companies that are currently involved in EDI. The next section will analyze the transaction set section of the EDI survey.

C. TRANSACTION SETS CURRENTLY USED IN THE PROCUREMENT ENVIRONMENT

This section addresses the question of what transaction sets are currently being utilized in the procurement environment. Table 7 presents the data from question 10 broken down between large and small businesses. Percentage wise, both large and small businesses are about equal in the number of subscribers to each transaction set. There does not

appear to be any difference in the transaction sets currently used between the two categories. However, of the 23 transaction sets listed in question 10 of the EDI Industry Survey, only six are currently sent and received by over 25 percent of the companies surveyed. It should be noted that not all companies surveyed are currently using EDI for procurement transactions. The six most commonly used transaction sets are as follows:

- 810 - Invoice
- 820 - Payment Order/Remittance Advice
- 850 - Purchase Order
- 855 - Purchase Order Acknowledgement
- 856 - Ship Notice/Manifest
- 997 - Functional Acknowledgement

While many of the 23 ANSI X12 transaction sets listed in question 10 would improve the efficiency of EDI, the six most commonly used transaction sets are critical to a company that uses EDI to conduct procurement business transactions. Transaction sets 810, 850, and 855 are the primary purchasing transactions used in industry. In addition, the three key EDI purchasing applications discussed in chapter II would not be possible without transaction set 820 for EFT and transaction set 856 for ERS and JIT. Transaction set 997, while not a true business transaction, is still an important component of EDI communications.

TABLE 7

NUMBER OF BUSINESSES CURRENTLY USING TRANSACTION SETS

TRANSACTION	SENDING			RECEIVING		
SETS	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL
511	1	1	**2**	1	1	**2**
810	4	36	**40**	3	24	**27**
820	1	21	**22**	3	26	**29**
830	1	12	**13**	3	13	**16**
832	3	7	**10**	1	6	**7**
836	1	1	**2**	1	0	**1**
838	1	0	**1**	1	0	**1**
840	1	6	**7**	1	8	**9**
841	1	1	**2**	1	1	**2**
843	1	8	**9**	1	5	**6**
846	1	4	**5**	1	5	**6**
850	3	36	**39**	5	41	**46**
855	3	25	**28**	1	22	**23**
856	4	29	**33**	1	25	**26**
858	1	5	**6**	1	6	**7**
860	1	16	**17**	2	21	**23**
861	2	9	**11**	2	13	**15**
862	2	6	**8**	2	11	**13**
863	1	5	**6**	1	4	**5**
865	1	11	**12**	1	10	**11**
869	1	1	**2**	1	2	**3**
870	2	5	**7**	1	3	**4**
997	8	54	**62**	9	52	**61**

ANSI X12 transaction set 511 is used primarily by DoD and not commercial industry. In fact, only three percent of thecompanies responding reported using or planning to use 511 in the future. The other transaction sets are, nonetheless, important if EDI is going to be used by DoD for other than just simple purchasing procedures. DoD needs to encourage industry to adopt these transactions sets before EDI can be fully implemented in the procurement and acquisition/ contracting environment. The following section will analyze the EDI implementation portion of the survey.

D. EDI IMPLEMENTATION ISSUES

The EDI implementation section of the survey was designed to determine what effect would requiring EDI as a condition for doing business with DoD have on commercial companies. The first two questions were asked to find out if EDI is being forced on companies. With 38 percent of the companies claiming that EDI was forced upon them and another 18 percent reporting that they have forced EDI on their trading partner, it appears that policy of requiring EDI as a condition for continuing to do business is commonplace in some commercial industries. This fact alone, however, should not be used as a sign that DoD can do the same. After all, the procurement environment of DoD is very different from that of commercial industry as noted in a recent LMI report. [Ref. 16:p. 4-11]

The fact that 85 percent of the companies responding have strong top level management support for EDI is not surprising. Due to the investment in time, money, and training involved, EDI implementation would be difficult, if not impossible, without top level support. Table 8 breaks down the question of top level management support by large and small business. From the data provided, 85 percent of the small businesses reported top level support and 87 percent of the large businesses reported top level support. There does not appear to be any correlation between the size of the business top level support. What was surprising was that only 49 percent of the companies had developed a strategic plan for EDI prior to implementation. This may be because the companies were forced into EDI without fully understanding EDI or how to fully utilize it. However, without a strategic plan, EDI is bound to be underutilized and possibly become a cost driver vise a cost saver. The successful implementation and operation of EDI depend upon a well thought out strategic plan endorsed by top level management [Ref. 24:p. 4].

The cost of EDI implementation will play a important role in a company's decision to use EDI. An overwhelming majority of the companies surveyed reported EDI implementation costs of over $30,000. Data from the implementation costs question was further broken down by large and small businesses in Table 9. The table shows that 82 percent of large businesses and 27 percent of the small businesses reported costs in excess of

$30,000. In addition, over half of the small businesses report costs in excess of $10,000.

Originally, the author concluded that high costs of implementation reported in the surveys was because most of the companies responding were large businesses and required more complicated hardware and training than would a small business. However, with over a quarter of the small business reporting costs in excess of $30,000, it appears that the classification of a company as a small business does not nessesarily mean that the cost of implementing EDI will not be expensive. Factors other than the just the classificaction of a company must play a role in the cost of EDI implementation. If large trading partners and DoD hope to persuade all trading partners (critical mass) to implement EDI, the problem of the high cost of implementation must be addresses and solved.

TABLE 8

NUMBER OF COMPANIES REPORTING STRONG TOP LEVEL SUPPORT FOR EDI

	STRONG TOP LEVEL SUPPORT? YES	No
SMALL BUSINESS	12 (85%)	2 (15%)
LARGE BUSINESS	68 (87%)	10 (13%)
TOTALS	80 (87%)	12 (13%)

TABLE NINE

IMPLEMENTATION COSTS

	SMALL BUSINESS	LARGE BUSINESS	TOTALS
LESS THAN $1500	0	1	1
$1500 TO $3,000	1	1	2
$3,000 TO $10,000	4	4	8
$10,000 TO $30,000	3	6	9
OVER $30,000	3	58	61

The last three questions in this section of the survey dealt with EDI software issues. To get a better sense of the availability of off-the-shelf EDI software to the critical mass, data from question 16 of the survey was further broken down into large and small business. From the data presented in Table 10, it appears that EDI software is available for small business, In fact, a greater percentage of small businesses purchased software than large businesses. This may be because the larger businesses have more capabilities to develop the software in-house.

TABLE 10

COMPARISON OF SOFTWARE TO SMALL BUSINESS CLASSIFICATION

	OFF-THE-SHELF	IN-HOUSE DEVELOPED
SMALL BUSINESS	7	5
LARGE BUSINESS	54	23
TOTAL	61	28

Tables 11 and 12 were developed from survey data concerning the integration of EDI software. From the data presented, it appears that integrate software is available for purchase to both large and small businesses. However, this software must be able to meet the needs of small, as well as large, businesses and still be affordable.

TABLE 11

COMPARISON OF INTEGRATION TO SMALL BUSINESS CLASSIFICATION

	INTEGRATED	NOT INTEGRATED
SMALL BUSINESS	10	3
LARGE BUSINESS	62	13
TOTAL	72	16

TABLE 12

COMPARISON OF INTEGRATION TO SOFTWARE TYPE

	INTEGRATION	NOT INTEGRATED
OFF-THE-SHELF	52	9
IN-HOUSE DEVELOPED	20	7
TOTAL	72	16

Table 13 was developed to compare the implementation costs of off-the-shelf software and in-house developed software. Table 14 was developed to compare the implementation costs of integrated software and non-integrated software. From the

data introduced in these two tables it appears that while EDI software is certainly a factor that adds to the cost of implementing EDI, the cost of integration is much more significant.

TABLE 13

COMPARISON OF IMPLEMENTATION COSTS TO SOFTWARE TYPE

	OFF-THE-SHELF	IN-HOUSE DEVELOPED
LESS THAN $1500	0	1
$1500 TO $3,000	1	1
$3,000 TO $10,000	6	2
$10,000 TO $30,000	4	5
OVER $30,000	45	16

TABLE 14

COMPARISON OF IMPLEMENTATION COSTS TO INTEGRATION

	INTEGRATED	NOT INTEGRATED
LESS THAN $1500	1	0
$1500 TO $3,000	1	1
$3,000 TO $10,000	8	0
$10,000 TO $30,000	5	4
OVER $30,000	53	8

The last question gives DoD some idea of how EDI is being used within the organizational structure of companies. From the results of the survey, it appears that EDI is being

integrated fairly equally within most functional areas of the companies including: procurement/contracting, accounting/ funds transfer, inventory control, transportation/ distribution, and other areas. While this is good news for EDI advocates, more studies need to be conducted to determine the extent of this integration.

The results of the implementation section of the survey tend to support the idea that DoD could eventually require EDI as a condition for doing business. However, constraints inherent in DoD's procurement environment must be resolved. In addition, DoD must ensure that all trading partners, no matter how small, understand EDI and its capabilities and provided training in using EDI. Lastly, the cost of EDI implementation, including integration with management information systems applicactions, must be made affordable to the critical mass. The EDI implementation problems encountered by the companies surveyed will be discussed in the next section.

E. EDI IMPLEMENTATION PROBLEMS AND SOLUTIONS

Several key EDI implementation problems were identified from the EDI Industry Survey. For instance, A significant number of respondents mentioned a lack of knowledge and understanding of EDI both within the organization and outside the organization with its trading partners. The lack of middle to upper management support for EDI development,

implementation, and resource allocation was another common complaint. Many respondents also noted problems with the integration of EDI with existing applications software. Lastly, many respondents had problems with commercial EDI software during implementation.

Most of the responding organizations also presented similar solutions to these implementation problems. EDI training and education throughout the organization was a common solution to EDI awareness and understanding. Other solutions to this problem included the use of software vendors, VANs, EDI Service Bureaus, and EDI users groups to increase the knowledge and understanding of EDI. The problem of the lack of management supports goes hand-in-hand with the EDI awareness problem. Management support was increased through the establishment of EDI steering groups composed of Vice Presidents and EDI coordinators from each department or functional area within the organization. Many respondents mentioned the presentation of a cost/benefit analysis of EDI to upper management as a way to gain the critical support required for EDI to be successful.

The use of steering committees was also suggested as a means to increase the integration of EDI with existing applications and management information systems. Often, the application systems had to be redesigned. However, the use of translation, EDI management, or bridging software was also used to solve many of the problems with EDI integration.

Participation by EDI users in EDI standards and industry groups and upper level management backing were also reported as helpful in working out many of the integration problems.

The problems encountered with EDI software were numerous. Many companies complained of the lack of available translation software. While other respondents stated that bugs in the software package that took a great deal of time to work out. Available software was not considered user friendly by many of the responding companies. Although the problems were many, the solutions were not. None of the surveys brought out any real solutions to the software problems other than just trial and error.

The survey brought out many problems encountered during EDI implementation; however, most problems were related to the ones just covered. All are, nonetheless, potential problems for DoD as EDI becomes "the way of doing business" in the very near future. The next section of this chapter will analyze the EDI operations portion of the survey.

F. EDI OPERATIONAL ISSUES

The last section of the survey was devised to ascertain how commercial industry is sending, receiving, and interpreting EDI transactions. More specifically, this section questions how the companies surveyed are ensuring the authentication/integrity of EDI transmissions and the protection of sensitive or classified EDI information. In

addition, this section determines the extent that VAN services are used and the capability of companies to create comprehensive audit trails of EDI transactions.

First, this sections shows that VAN services are widely used in commercial industry. With all the services offered by these third party networks, it is not surprising that 88 percent of the responding companies reported using VANs to some extent. Data was compiled in Table 15 to compare the use of VAN services between small and large businesses. From the data presented, it appears that VANs are used in an equal amount by both business classifications. A corresponding high number of respondents also reported to have the capability to create comprehensive audit trails of EDI transactions. The author initially concluded that this was likely due to the fact that this is one of the services provided by most VANs. However, data from Table 16 shows that 77 percent of the companies that do not use VANs are still able to create comprehensive audit trails of EDI transactions. So while 93 percent of the companies that use VANs are able to create audit trails, it does not appear that there is a correlation between the use of VANs and the ability to create audit trails.

Over a third of the companies surveyed also reported relying on the services of VANs to ensure EDI message authentication and integrity. Again, this is not surprising. However, many companies do possess the ability to authenticate

EDI messages and ensure integrity on their own. One interesting note is that only three percent of the these companies use a PKE based authentication or integrity scheme. Yet, this is the system which DoD is planning to base its digital signature standard on. The limited use of PKE by private industry is more than likely due to the fact that PKE is a very new concept and confusion over standards on PKE still exists.

TABLE 15

COMPARISON OF VAN USE TO BUSINESS CLASSIFICATION

	SMALL BUSINESS	LARGE BUSINESS
USE VANS	12	83
DO NOT USE VANS	2	7
TOTALS	14	90

TABLE 16

COMPARISON OF VAN USE TO ABILITY TO CREATE AUDIT TRAILS

	ABILITY TO CREATE AUDIT TRAILS	
	YES	NO
USE VANS	76	5
DO NOT USE VANS	7	2
TOTALS	83	7

The last item to be discussed in this section is question of how industry is protecting sensitive or classified EDI information. Again, a third of the companies reported relying of VANs for this protection. What was surprising about this question was that over 30 percent of the companies do not currently protect this information. Most of these companies stated that they did not deal with sensitive or classified information. The last third of the responding companies reported using their own method or other means of protection of this information. DoD should conduct further studies into how industry is protecting sensitive or classified information to determine it any of the methods could be used in DoD. Analysis of EDI operations is continued in the next section where problems encountered by the companies surveyed will be discussed.

G. EDI OPERATIONAL PROBLEMS AND SOLUTIONS

Of the four most common EDI operational problems identified in the survey, the apparent lack of EDI standards among different trading partners was the main problem encountered by most companies responding. This was also considered one of the hardest problems to solve. Another common problem encountered after, as well as during, implementation was the integration of EDI with existing applications. The respondents also note having problems attracting a sufficient number of EDI ready trading partners.

As a result, several respondents were having difficulty recouping EDI development costs. Finally, many respondents have had problems with data integrity and timeliness of transmissions.

The problem of standardization of EDI transactions is not new. EDI users have been battling this problem since EDI was first developed. The problem is magnified as a increasing number of trading partners are added from across industry lines. ANSI X12 and EDIFACT standards were developed to solve the problem of standardization. In actuality, these standards have been found to be too ambiguous. Consequently, specific data elements are open to many different interpretations. In addition, trading partners many have to handle different proprietary definitions and required free format text data elements. Add to this the many proprietary standards still in existence, and the EDI user is faced with some very serious and often confusing problems.

Unfortunately, the surveys did not provide any real solutions to the problem of EDI standardization. However, one solution mentioned most often was simply to subscribe to and support ANSI X12 and EDIFACT standards and encourage your trading partners to do the same. Another solution was to maintain constant communications with trading partners and resolve conflicting standards as they arise. As a last resort, many respondents reported having to develop a customized mapping of each variation of the X12 standard

transaction set before being able to receive that transaction set.

Solutions to the EDI integration problem with existing applications were the same as those noted under question 26. One additional recommendat: ovided was to ensure that mapping was completed before a . apting to integrate EDI with the application function.

Many respondents noted that they were not able to attract enough EDI ready trading partners to recoup the cost of EDI development. Another similar problems was that it was taking too long to add trading partners once they were ready for EDI. Again, many trading partners are either not aware of EDI or simply do not understand it. Many of the larger companies were conducting educational seminars on EDI for their suppliers and vendors. Others were creating EDI software packages for the smaller suppliers and vendors. In addition, some companies were taking advantage of EDI Service Bureaus for assistance in establishing smaller trading partners. Still, other companies were developing partnerships with VANs to assist in bringing up trading partners. One thing that was noted more than once was that it might be counter-productive to force EDI on suppliers and vendors. Instead, larger trading partners needs to show that EDI can be a win-win situation for all trading partners. DoD should carefully consider all these options before requiring the use of EDI for all procurements.

The last major problem encountered after implementation was the problem of data integrity. That is, data such as price, unit of issue, or part number are not always correct. The only way noted to resolve such problems was through communication with the trading partner and maintaining a complete audit trail of every transaction.

Most of the problems experienced after EDI implementation are of a continuous nature. Although attempts to resolve them are underway, many will only be solved with time.

H. CHAPTER SUMMARY

An analysis of the survey data presented in Chapter III was provided in this chapter. The analysis was divided into six sections. The first section looked at the background of the companies surveyed and found that the companies represented a wide range of EDI activity. Due to this range of activity, the researcher concluded that the companies's answers to the survey questions should be representative of other companies that are currently involved in EDI.

The next section analyzed the transaction sets currently used being used by industry in the procurement environment. Six commonly used transaction sets were identified. While these six transaction sets are able to support simple purchase procedures, many more transaction sets transaction sets will

have to be adopted before EDI can be used for all DoD procurements.

EDI implementation issues and problems identified in the survey were analyzed next. The high costs of EDI implementation and integrated software were identified as a barriers that must be overcome before EDI is accepted and implemented by the critical mass. In addition, it was concluded that DoD and other large trading partners must provide training and support to the critical mass before the full benefits of EDI can be realized.

The last section examined EDI operational issues and problems identified in the survey. VANs services were found to be widely used in commercial industry to ensure the authentication, integrity, and protection of EDI transactions. However, the author also concluded that many commercial companies are able to ensure these services without relying on VANs and that DoD should study their methods for possible use within DoD. Research conclusions and recommendations are present in the following chapter.

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The primary purpose of this thesis was to determine how EDI is being used in private industry and how that information can be used to enhance "electronic commerce" in the Department of Defense. While there have been many studies which have examined the capabilities of EDI and matched them to potential opportunities within DoD, this thesis focused on how private industry is implementing EDI and specifically how EDI is being used in the procurement and acquisitions environment [Ref. 1, 2:p. iii], [Ref. 3:p. iii], [Ref. 13:p. iii], [Ref. 15:p. iii], [Ref. 16:p. iii]. The principal conclusions, drawn from the analysis conducted in the previous chapter, will now be presented. Following the conclusions, recommendations based on the same will be presented.

1. EDI is here to stay.

EDI, like many innovative communication technologies of the past such as the telegraph and telephone, will soon be a common method of conducting business. While the understanding and acceptance of EDI by both the private and public sectors may not be progressing as fast as first predicted, within the next decade an organization's ability to conduct business

transactions with EDI will be essential to remain competitive. Industry and the Federal Government must be the catalyst to push EDI as the "way of doing business" and resolve any impediment to this end.

2. *Most issues associated with EDI in the procurement environment will be resolved with time and experience.*

The problems currently associated with EDI such as security, integrity, authentication, hardware and software compatibility, and outdated Federal Procurement Regulations will be resolved as industry and DoD gain experience with prototype EDI purchasing and contracting systems. As acceptance of EDI continues to grow, the necessity for and improvements in technology advancements and software developments will increase. Private and public sector organizations have already eliminated many barriers to EDI use; time and experience will resolve the rest.

3. *DoD and private industry will not recognize the full benefits and savings from EDI until EDI is adopted by the critical mass.*

Even if all other impediments to EDI implementation are resolved, a major portion of both large and small businesses will not implement EDI until it is to their economic advantage to do so. EDI implementation costs are still too high and knowledge/understanding of EDI and its benefits are still too

low for many organizations to justify adoption. Affordable, integrated, user friendly EDI software that can manage all the different EDI conventions and standards is still not available to the critical mass. In addition, many small businesses have never heard of EDI much less understand how they will benefit from it. Until these two major impediments are resolved, EDI will not be adopted by the critical mass and the full benefits of EDI will not materialize.

4. *Successful operation of EDI depends upon the amount of top level management support of EDI as well as a thought out, detailed strategic EDI implementation plan.*

Even if the cost of EDI implementation is reduced through the availability of affordable software, an organization will still have to invest a great deal of time and resources in education and training. Without the support of top level management, EDI will not get the attention needed to ensure it is properly funded, utilized, and integrated into entire organization. In addition, before EDI is implemented each potential EDI business transaction should be studied to determine how to best utilize the capabilities of EDI. If the EDI transaction just automates a paper-based system, the full utilization of EDI technologies may not be realized. A strategic plan should be written with the understanding that EDI can improve the process as well as the speed of a business

transaction. The strategic plan should focus on the concept of buying goods, not on the method buying goods [Ref. 9]. If EDI is implemented properly, it will change the way procurements are conducted.

5. *The transaction sets currently being used by private industry for procurements and acquisitions limit DoD EDI opportunities for large purchases.*

The six most common transaction sets currently being used in private industry (identified in Chapter IV) are able to support the low value, repetitive purchases which make up the bulk of procurement transactions in DoD. However, until private industry adopts more of the transaction sets listed in Table 2 on page 54, EDI opportunities will be limited for large purchases in DoD. In addition, the volume of text required for many competitive procurements may be too large for current EDI systems to handle [Ref. 15:p. 2-2]. Nonetheless, technological advances in telecommunications should eventually resolve this problem. Until that time, EDI uses in large procurements will limited to sole-source basic ordering agreements (BOA) and indefinite delivery-type contracts (IDC) [Ref. 15:p. 2.2].

B. RECOMMENDATIONS

1. *The FAR should be modified as recommended by LMI in references 15 and 16.*

LMI presented a very detailed list of proposed changes to the FAR. The purpose of these changes are to remove any regulatory impediments to electronic commerce and allow the use of EDI in the procurement environment. By removing these impediments, DoD will be in a better position to recognize electronic technologies and media, and permit electronic solicitations, offers, and contracts. Without these changes, EDI utilization will be extremely limited in DoD procurements and acquisitions. However, contracts such as indefinite-delivery, multiple-award schedule, and spares provisions are all examples where EDI can be beneficial without many changes in acquisition regulations.

2. *The dollar threshold for small purchases procedures should be raised to $200,000 to allow immediate expanded use of EDI in Federal procurements.*

It will take time to modify the FAR and persuade private industry to adopt all the transaction sets required to utilize EDI for large government purchases. By raising the Dollar limit for small purchases, DoD can recognize immediate benefits from EDI from a much larger range of procurements that would have otherwise been classified under large purchase procurements.

3. *DoD and private industry must jointly fund the development of EDI communication technologies, integrated software packages, and education programs that will eliminate the impediments to adoption of EDI by the critical mass.*

Without the support of the critical mass, both DoD and large private companies will be unable to recognize the full potential of EDI. It is highly unlikely that individual industry conventions will be eliminated. Therefore, DoD and other large EDI stakeholders must work together to accelerate the development of EDI technologies that will allow small businesses to handle multiple industry conventions and standards easily and economically.

The cost of integrating EDI with the other functional areas of a business is a major contributor to the high cost of EDI implementation. However, without this integration, the benefits of EDI may never be realized. Therefore, large EDI stakeholder must also subsidize the development of affordable integration software packages for use by smaller trading partners that would otherwise be unable to integrate EDI into their organization.

DoD and other EDI stakeholder have not done too good of a job promoting EDI to the critical mass. Both small and large business must be shown how EDI will benefits them. In addition, they must be trained on how to develop strategic plans for EDI implementation. Many larger trading partners

have begun to offer training seminars on EDI to their trading partners; DoD will have to do the same. DoD should also consider using already established organizations such as Procurement Assistance Centers and EDI Service Bureaus to educate and train small business on EDI. Once the critical mass is aware of the benefits of EDI and implementation costs have been reduced to an affordable level, the adoption of EDI by the critical mass should be a win-win situation for all trading partners concerned.

4. DoD should ensure all employees are educated and trained in EDI.

Jim Abbott of TRW said it best when he stated that "the best approach to improving business processes it to simplify, standardize, automate, and integrate" [Ref. 22:p. 36]. All four requirements have been included in *DoD Implementation Guidelines for Electronic Data Interchange (EDI)*. However, a fifth requirement should be added to this approach - educate. The people who will be using EDI and those who's job description may change due to EDI will more than likely fear this new technology [Ref. 12:p. 4]. They need to understand it and be comfortable with it, before they will support EDI. In addition, they should be kept abreast of what changes to expect; and most importantly, they need to be assured that they will not loose their job because of EDI. Top level support from DoD will be required to ensure everyone involved

in EDI implementation and integration is trained in EDI. If DoD requires that all five requirements be completed before implementing EDI into each system, the benefits from EDI should far outweighs the costs and DoD will be ready for EDI.

C. AREAS FOR FURTHER RESEARCH

The following related subject areas should be targeted for further research:

- Research conducted to explore how the EDI applications of JIT, ERS, and EFT can be further utilized in DoD.
- Research conducted to compare and contrast the transaction sets used by industry and those used by DoD in the procurement and contracting area.
- Research conducted to explore how best to train and educate all potential DoD trading partners in EDI.
- Research conducted to study the impact of EDI on procurement related job descriptions in DoD.
- Research conducted to study methods that private industry are using to ensure the security of their EDI transactions and how these methods might be utilized in DoD.

APPENDIX A:

EDI INDUSTRY SURVEY

BACKGROUND INFORMATION: (circle/checkappropriateanswer)

1. Is your organization designated as a "small business"?
   __ Yes
   __ No

2. What was your organization's total sales for fiscal year 1992?
   $_____

3. What EDI standards are you currently using? (check all that apply)
   __ a. ANSI/X12 (skip question 4)
   __ b. UN/EDIFACT (skip question 5)
   __ c. other (please list)_____

4. Are you planning to change to ANSI/X12 standards within the next five years?
   __ Yes
   __ No

5. Are you planning to change to UN/EDIFACT standards within the next five years?
   __ Yes
   __ No

6. What implementation guidelines are you using?
   __ a. AIGA - Automotive Industry Action Group
   __ b. AIA - Aerospace Industry Association
   __ c. CIDX - Chemical Industry Data Exchange
   __ d. EDIA/TDCC - EDI Association / Transportation Data Coordination Comm.
   __ e. EDX - Electrical Industry Data Exchange
   __ f. EIDX - Electronic Industry Data Exchange
   __ g. PIDX - Petroleum Industry Data Exchange
   __ h. TMA - Treasury Management Association
   __ i. VICS - Voluntary Interindustry Communication Standard
   __ j. Utility Industry Group
   __ k. WINS - Warehouse Industry Standard
   __ l. Other (please list)_____
   __ m. None

7. How many trading partners do you have?
   _____

8. How many EDI transactions do you receive each month?
   _____

9. How many EDI transactions do you send out each month?
   _____

TRANSACTION SET INFORMATION: (circle the appropriate answer)

10. Do you send/receive the following ANSI/X12 transaction set(s) to/from your trading partners?

	SEND			RECEIVE		
a. 511 Requisition	Yes	No	In process	Yes	No	In process
b. 810 Invoice	Yes	No	In process	Yes	No	In process
c. 820 Payment Order/	Yes	No	In process	Yes	No	In process
d. 830 Planning Schedule	Yes	No	In process	Yes	No	In process
e. 832 Price Sales Cat.	Yes	No	In process	Yes	No	In process
f. 836 Contract Award	Yes	No	In process	Yes	No	In process
g. 838 T/P Profile	Yes	No	In process	Yes	No	In process
h. 840 RFQ	Yes	No	In process	Yes	No	In process
i. 841 Spec./Tech.Info	Yes	No	In process	Yes	No	In process
j. 843 Response to RFQ	Yes	No	In process	Yes	No	In process
k. 846 Inv. Inquiry	Yes	No	In process	Yes	No	In process
l. 850 Purchase Order	Yes	No	In process	Yes	No	In process
m. 855 PO. Acknowledg.	Yes	No	In process	Yes	No	In process
n. 856 Ship Notice/Man.	Yes	No	In process	Yes	No	In process
o. 858 Shipment Info.	Yes	No	In process	Yes	No	In process
p. 860 PO. Change	Yes	No	In process	Yes	No	In process
q. 861 Receiving Advice	Yes	No	In process	Yes	No	In process
r. 862 Shipping Schedule	Yes	No	In process	Yes	No	In process
s. 863 Rpt of Test Result	Yes	No	In process	Yes	No	In process
t. 865 PO. Change Acknowl	Yes	No	In process	Yes	No	In process
u. 869 Order Status Inq.	Yes	No	In process	Yes	No	In process
v. 870 Order Status Rpt	Yes	No	In process	Yes	No	In process
w. 997 Functional Ack.	Yes	No	In process	Yes	No	In process

EDI IMPLEMENTATION:

11. Was EDI forced upon you as a condition for continuing to do business with a trading partner?
    __ Yes
    __ No

12. Have you required your vendors/suppliers to implement EDI as a condition for continuing to do business with you?
__ Yes
__ No

13. Is there strong support for EDI from top level management within your organization?
__ Yes
__ No

14. Did you develop a strategic plan for EDI prior to implementation of EDI?
__ Yes
__ No

15. What was the total cost of EDI implementation within your organization?(estimated cost of additional hardware, software, training...etc.)
__ a. Under $1500
__ b. Between $1500 - $3000
__ c. Between $3000 - $10,000
__ d. Between $10,000 - $30,000
__ e. Over $30,000

16. Did you purchase a commercial off-the-shelf EDI software package?
__ Yes
__ No

17. Is your EDI software integrated with your in-house management information system? That is, you do not have to re-key any incoming EDI transactions to complete the task.
__ Yes
__ No

18. What functional areas capabilities within your organization have integrated EDI? (check all that apply)
__ a. Procurement/Contracting
__ b. Accounting/Funds transfer
__ c. Inventory control
__ d. Transportation/Distribution
__ e. Other_____

EDI OPERATIONS:

19. Do you utilize Value Added Network (VAN) services?

__ Yes
__ No

20. How do you ensure that EDI messages are authentic?

__ a. Rely on VAN services for authentication.

__ b. Use your own authentication scheme.

__ c. Do not require authentication.

21. How do you assure the integrity of EDI messages?

__ a. Rely on VAN services.

__ b. Use your own integrity assurance scheme.

__ c. Do not assure integrity.

22. If your own authentication or integrity scheme is used, is it Public Key Encryption (PKE) based?

__ a. Yes
__ b. No
__ c. Do not know

23. How do you protect sensitive or classified EDI information?

__ a. Rely on VAN services for protection.

__ b. Use your own encryption mechanism.

__ c. Do not currently protect sensitive/classified EDI information.

__ d. Other (please describe)

_____
_____
_____
_____

24. Do you have the capability to create comprehensive audit trails of EDI transactions

__ Yes
__ No

25. What problems did you encounter during the implementation of EDI?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

26. How did you solve these implementation problems?

27. What problems have you encounter since implementing EDI?

28. Have these problems been solved? If so, how?

29. What principle purchasing and acquisition applications have resulted from EDI implementation (ie. Just-In-Time (JIT) inventory, Evaluated Receipts Settlement (ERS),...ect)?

30. May I call for a follow up interview?
__ Yes
__ No

31. **Your Name:**_____

32. **Your Title:**_____

33. **Name of your Organization:**_____

34. **Telephone Number:**_____

35. **Fax Number:**_____

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS SURVEY. YOUR EFFORTS ARE MOST APPRECIATED. INFORMATION COLLECTED WILL ASSIST IN DoD'S IMPLEMENTATION OF EDI.

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