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Electronic Data Interchange: Guidelines for Development, Implementation, & Use

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Introduction

Electronic Data Interchange (EDI) provides new and expanded methods for communications between business partners. EDI is the inter-organizational transmission of business transactions in a standard format. With EDI, companies can bypass the traditional methods of sending physical documents, and instead send electronic ones. EDI is a form of communication that promises increased productivity.

The original aims of EDI were to reduce cycle time and replace paper with electronically transmitted documents between trading partners (Figure 1). But, the contribution of EDI to business has grown beyond the goals of paperless high-speed communications. EDI is transforming entire industries. ATM networks and electronic-funds-transfer systems have altered the way we bank and trade securities. Now EDI is changing the face of retailing, supplier/customer relations, international trade, and many other areas. EDI represents an opportunity to directly improve business processes and business controls.

Traditionally, organizations have used paper forms such as acknowledgements, orders, inquiries, checks, and the like to exchange information. But large volumes of paper-based exchanges created problems because they are slow and require extensive human handling. Many organizations have realized the importance of finding a more expedient way to communicate and process business data.

There were 21,000 registered EDI users in 1991. In 1993, Data Interchange Standards Association, Inc. (DISA) reported that 37,000 companies were using EDI in the USA. Internationally, Singapore and Hong Kong both regard EDI as an important source of competitive advantage in trade. Australian Custom Service also uses EDI to communicate with European countries.

Technically, there are few barriers to implementing EDI. The implementation of EDI is more a management problem; because, to really do it properly requires a complete rethinking of organizational structure, processes, procedures, and methods of doing business. This paper identifies several important issues associated with EDI development, implementation, and use. These factors, which include EDI technical considerations and implementation strategies, can serve as guidelines for organizations contemplating the use of EDI.

Technical Components of EDI

Technically, an EDI system involves four major components: standards, hardware, software, and a communications network. These are described below.

EDI Standards:

The foundation of EDI is derived from conventional, standardized document exchange schemes which were developed during the 1960s in the transportation industry. As these systems of electronic data exchange gained in popularity, companies in other industries began to implement EDI. However, without common standards, companies experienced difficulties resulting from the proliferation of protocols, procedures, and data formats used in the interchange of electronic information. The need for a uniform method for implementing and using EDI soon became apparent.

In the late 1970s, the American National Standard Institute (ANSI) chartered a new committee, ASC X.12, to develop EDI standards. In 1993, the ASC X.12 version 3 EDI standard was published. The X.12 committee is administered by a non-profit organization, known as the Data Interchange Standards Association or DISA. Currently, there are about 650 organizational members in DISA. The X.12 standards specify the format and data content of electronic business transactions. Business information is formatted according to the standard before transmission.

ASC X.12 has two major sets of standards: foundation standards and transaction set standards. Foundation standards define the syntax of X.12 EDI, as well as the data elements, data segments, and control structures. Data control structures include the X12.3 data-element dictionary, the X12.5 interchange control structure, the X12.6 application control structure and the X12.22 segment dictionary which defines segments.

Transaction set standards contain three components: functional group, transaction set, and data element. A functional group is a group of similar transaction sets (e.g., shipping notices), and is bounded by a functional group header and trailer segment. Within the functional group, there are transaction sets. A transaction set is a set of data that is exchanged between two trading partners. Typical examples of transaction sets include shipment status reports, bills of lading, invoices, purchase orders, product activity data, and functional acknowledgments. The data element is the smallest unit of information in the standards. Data elements are defined in the X12.3 data element dictionary by using a reference number.

Although the United States has adopted the ASC X.12 standard, a different standard, EDIFACT, is used internationally. EDIFACT was developed by the United Nations in 1987, and has gained widespread use in Europe and Asia. It is becoming the leading EDI protocol for international information exchange. Several vendors have added EDIFACT compatibility to products that support X.12. Thus, EDIFACT has become the standard of choice for those who have international trading partners.

EDI Hardware and Software:

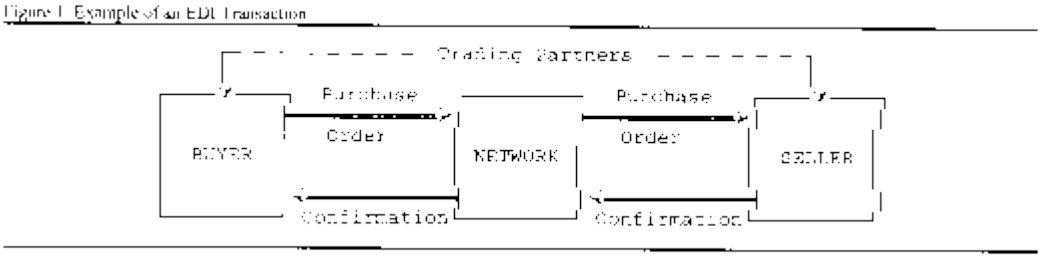
EDI can be implemented on virtually any hardware platform. For a small company with relatively few trading partners and a small number of transactions, a microcomputer with a modem could suffice. For firms that process a high volume of EDI transactions and have numerous trading partners, a minicomputer- or mainframe-based system is possibly needed. In addition to hardware, a firm must purchase or develop software to process and transmit EDI transactions.

Generally, three types of software are involved: communication software, translator software, and management software. Communication software facilitates computer interactions among trading partners through networks so that they can send and receive EDI data. Translator software usually translates data from internal data formats into a standard EDI format (e.g., X.12) and also validates data with the standards; although, sometimes other data conversion requirements are accomplished. Management software manages EDI data for transmission and archives these data for auditing purpose.

Although relatively easy to implement technically, a company may not realize productivity gains from EDI because of replicated effort due to a lack of integration of EDI with other applications. In fact, productivity may actually decline if the development and implementation of EDI is not well-planned and well-executed. In order to achieve the maximum benefits, it is important that the EDI application becomes a communications extension of existing applications. This issue of integration will be examined more completely below in the context of EDI development and implementation strategies.

EDI Communications Networks:

Generally, a value-added network (VAN) provides the electronic mailbox service



that stores and forwards data between trading partners. It functions like a communications server for organizations using EDI. Currently, there are more than twenty VAN providers in North America. A VAN is not needed if a company chooses to link directly with its trading partners, either through leased lines, a public-switched network, or a private network. However, as the number of trading partners increases, direct links are complicated and impractical for a single company to handle. A third-party VAN provider simplifies EDI interfaces among different organizations. Once an EDI document is sent via the communication software, it is stored in the VAN until the receiving trading partner is ready to accept the document.

For convenience and backup purposes, it is not unusual for a company to use more than one VAN. The use of redundant VANs, not only accommodates trading partners who use different VANs, but also provides alternative communications channels should one or more of the VANs fail. In addition to providing interconnections among companies, a VAN often provides additional services for a fee. For example, data-format translation services allow the receiving partner to receive files in an application-readable format requiring no additional conversion. As more organizations use EDI, it is anticipated that the demand for VAN services will increase.

EDI Development & Implementation Strategies

EDI is not just a technological innovation: It provides a new way of doing business. The use of EDI not only results in increased efficiency and effectiveness, but can facilitate the reengineering of business processes as well. However, the benefits of EDI cannot be realized without proper implementation strategies, both technically and organizationally. The development and implementation of EDI can be divided into four main phases of activity: planning, analysis and design, construction and installation, and operations.

Planning Phase: The implementation of EDI will ultimately involve changes in the way a company conducts business. A company must evaluate its present business processes and address the impact of EDI. Factors such as organizational structure, management practice, economic feasibility, corporate culture, internal data flows, applications affected, and trading partner relationships all must be considered. Educating user personnel about how the company, as well as how individual employees, will benefit from the implementation of EDI is also critical. As with any organizational change, top management's visible commitment to the EDI project plays a key role in its successful implementation.

One of the biggest obstacles to a successful EDI program is obtaining the cooperation of trading partners. Major EDI users agree that business partners, especially smaller companies, are often reluctant to implement EDI because of the cost and necessary changes in business processes and organizational structure. It is estimated that approximately two-thirds of EDI users have been prodded by their trading partners into using EDI. Bringing trading partners on board is one of the most critical tasks in planning for EDI success. When electronic funds transfer is anticipated as part of the EDI implementation, this includes banks as trading partners.

Some organizations have even taken a somewhat determined approach with their trading partners. For example, General Motors (GM), Sears, K-Mart, and Levi Strauss have all notified their suppliers that they will no longer do business with those who do not use EDI. Although, to facilitate the transition, training and software are often provided to trading partners. A project proposal is the output of the planning phase.

This proposal should outline the economic feasibility, proposed changes to business processes and applications, impact on business strategies, potential changes in relationships with business trading partners, a preliminary timetable, resource

requirements, and an estimate of costs and benefits (both tangible and intangible) for the development and implementation of EDI. A decisive go/no-go decision from the highest appropriate management level, preferably the top, is required to proceed to the next phase.

Analysis and Design Phase: With management acceptance of the project plan, and a loud and clear message of management support, the EDI development and implementation process enters the analysis and design phase. During analysis, a thorough study is conducted to identify the functional areas within the company that may be affected and to determine the applications that will benefit from EDI integration. After the applications are identified, hardware and software, as well as value-added networks for EDI communications and support systems, are evaluated and selected. User participation in these activities is essential. This not only facilitates needs identification, but also reduces users' frustration and fear of losing control over their operations when EDI is installed.

One of the critical tasks of analysis is to make sure the EDI application software can interface and communicate with existing applications, as well as with the selected network. It is necessary to ensure the seamless integration from one trading partner's application to the other's. This may require modifications to existing applications, the incorporation of special data-conversion or translating software, VAN-provided conversion services, or some combination of these three options. Without integrating the whole process, the benefit of using EDI cannot be fully realized. Externally, a company has to communicate with trading partners regarding the version of the standards that will be used, as well as the data formats for exchange. Usually, customers expect suppliers to convert to their own product codes, or to plan for data conversion as required. This may entail much complexity and require extensive work if one supplier has many customers. Many industries, often through industry trade associations, have defined standard industry formats for exchange. Industry guidelines can simplify matters and should be identified.

Based on the requirements defined through analysis, the communication standards are finalized. Then, the communications infrastructure (hardware, software, and network), user interfaces, and translation formats have to be designed. The frequency and method of transmission, such as using direct or third party networks (like VANs), should be defined based on need and negotiations with trading partners. The use of a third-party network, may serve to resolve some communication problems if trading partners use different protocols.

The translator interface software, communication software, and management software selections all have to be resolved during design. It is often more practical to purchase software than to build it in-house due to the cost, time, and expertise required. Whether purchased, custom-made, or something in between, a company must determine how to best interface the existing applications in order to make data available to and from the EDI systems.

The design team must review the data to be interchanged and map all data elements to the standard format. As mentioned earlier, to maximize the benefit of using EDI, all related applications should be EDI-integrated. In design, all pertinent applications and data conversions should be mapped out. Other issues, such as security, agreements between partners, backup, disaster recovery, and error recovery should also be addressed.

The output of the analysis and design phase is a detailed technical blueprint, including a budget for EDI hardware, software, network, and standards. This detailed blueprint covers everything from user-interface screens to communication protocols and data formats. In light of this more comprehensive understanding, a review and refinement of the details of the original project proposal is in order. Economic feasibility and cost-benefit analysis should be revisited. Impacts on business strategies, processes, and applications, as well as on relationships with trading partners, should be reassessed. A detailed project plan and timetable should also be developed. Again, to proceed further, a definitive go/no-go decision from top management is required, if the project is to succeed.

Construction and Installation Phase: During development and installation, all data-handling, interface, and application software must be acquired, customized, and tested. The development team should conduct pilot tests by sending sample data to trading partners for evaluation and should insure that trading partners have adequate translation interfaces, as well as sufficient information to interpret correctly the transmitted data. Users should participate in testing and fine tuning interface screens. Documenting the operating procedures, such as sending/receiving, recovery, functional acknowledgement, and so forth, are all necessary tasks of development.

It is also important to thoroughly train and continually communicate with the users of all trading partners. With the installation of EDI, the users' business processes and workflows change dramatically. Technical innovation alone does not guarantee the success of a business. The contribution of EDI depends on how well it improves business processes, increases productivity, and helps employees do their jobs. Therefore, the development team, the user community, and management should work closely to insure that this new system is understood, accepted, and supported. This cooperation and coordination not only applies within organizations, but also between trading partners. Before taking the system operational, a go from top management is needed.

Operations Phase: As with any information system development project, problems will arise. The development team should observe and monitor system operations and collect feedback from users and trading partners to reveal problems to be corrected. Constant evaluation, continuous improvement, and exploration of new opportunities for EDI help maximize its payoffs.

GM's EDI team is a successful example. Once installed, they continued giving workshops to employees and promoting the EDI concept. In addition, GM's EDI team constantly helps their trading partners in implementing and updating their EDI operations. Active involvement in regional and national EDI forums, and generously providing seminars and

training to academic institutions have earned GM a reputation as a front runner in the use of EDI.

Summary and Conclusion

EDI can provide many competitive advantages to an organization from reduced costs, shortened cycle time, and other benefits. Technology, however, cannot guarantee the success of a business, only facilitate it. In fact, many companies have negative experiences with the use of EDI A well-planned and well-executed development and implementation process, as described above, is necessary for the successful adoption of EDI. In order to succeed, such a process must include both the technical and the human components of EDI. The critical success factors for EDI projects include:

1. A thorough and comprehensive project plan developed through information systems planning, analysis, and design activities. Business processes and applications that will benefit from EDI integration must be identified and a detailed technical blueprint, budget, and timetable determined.

2. The visible commitment of top management. This is critical to the success of EDI projects.

3. The cooperation of trading partners, including financial institutions when required, is also critical for EDI success.

4. User participation in planning, analysis, design, construction, and installation is also necessary for project success. This includes trading partner users.

5. Build a good system. The seamless integration across applications, as well as among organizations, is a required. Adherence to standards and industry guidelines is also important. Moreover, the system must be thoroughly tested at every level, and this testing must include users.

6. Educating end users is also critical. Ensure that the users of all trading partners are thoroughly trained.

7. Foster continuous communication, cooperation, and coordination among users, managers, and the project team. Not only within your own organization, but also with trading partners.

8. Encourage the constant evaluation, continuous improvement, and ongoing exploration of new opportunities for EDI among all stakeholders. EDI is a strategic management issue which represents a new way of doing business. In the future, every transaction between trading partners may become EDI-based. The growing commercial use of the internet suggests that companies will either use EDI or risk losing business. Technically, there are few barriers. However, EDI's advantage will be very limited if companies do not take an integrated and comprehensive approach.

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