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An EDI Transaction Set Development Lifecycle (TSDL): A Case Study in the Food Manufacturing Industry

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ABSTRACT

Electronic Data Interchange (EDI) is widely regarded by organizations worldwide as the business standard for the timely and secure exchange of electronic business transactions in an expanding global marketplace. While numerous research efforts have explored how the adoption, implementation, and integration of this technology can impact an organization's technical, organizational, and competitive environment - few studies have documented the process used by organizations to implement EDI transaction sets with trading partners. This paper advances an innovative lifecycle used by a food manufacturing company to successfully design, implement, and test an EDI transaction set. This paper also describes how this transaction set development lifecycle (TDSL) can be integrated into an organization's standard systems development lifecycle (SDLC) to ensure the timely completion of IT projects. Finally, a discussion of the impact of the TDSL on the organization's business practices is presented.

INTRODUCTION

Electronic Data Interchange (EDI) is widely acknowledged by organizations worldwide as the benchmark e-commerce standard for the timely exchange of business-to-business (B2B) transactions between trading partners in today's highly networked business marketplace. The total annual estimated value of EDI transactions worldwide ranges from \$1.8 trillion to \$3.2 trillion (Drickhamer, 2003). These numbers clearly demonstrate the significant impact this technology has had on business operations for over two decades. While some organizations are now exploring the possibility of leveraging the capabilities of XML technology to exchange business transactions

using the Internet, there is little indication that larger established business enterprises are in a hurry to adopt a new B2B technology. A study by the research firm IDC found that traditional EDI commerce would continue to have a compound annual growth rate of 8.4% through 2006. These findings indicate that EDI will continue to be the dominant B2B technology for the near future.

Numerous prestigious academic journals and popular business periodicals have documented the myriad of reasons for the popularity and longevity of this technology (Banerjee and Sriram, 1995; Chwelos et al., 2001; Mukhopadhyay et al., 1995; Premkumar et al., 1994; Sokol, 1989). EDI has justifiably been called the technology the organizations “love to hate” due to the many distinct benefits and challenges associated with the implementation and on-going operation of an enterprise EDI system. The operational, organizational, competitive, and strategic benefits associated with the adoption of EDI by organizations have been well established within the IT literature (Iacovou et al., 1995; Jelassi and Fignon, 1994; Massetti and Zmud, 1996; Takeoka et al., 2000; Wang and Seidmann, 1995). The successful implementation of EDI has been found to improve product/service quality, enhance organizational cash flows, reduce inventory management issues, improve operational efficiency, and increased competitive advantage (Barua and Lee, 1997; Bergeron and Raymond, 1992; Emmelhainz, 1988; Lee et al., 1999; Saunders and Clark, 1992). While the benefits of EDI are widely praised by organizations that selected EDI to facilitate their B2B commerce, these same organizations are quick to point out the technological, operational, and financial issues that have limited the world-wide adoption of this technology (Hart and Saunders, 1997; Scala and McGrath, 1993). Business process re-engineering requirements, significant software integration effort, and extensive hardware / software / communications expenses have made it difficult for medium to smaller firms to readily embrace EDI as business critical technology (Hart and Saunders, 1998; Raghunathan and Yeh, 2001; Srinivasan et al., 1994). Although these operational costs serve as the most visible impediments to the adoption of EDI, it is on-going systems support costs (personnel costs) that are most often cited as the primary drawback to EDI technology adoption (Emmelhainz, 1990). Depending on the role that EDI plays in an organization’s business strategy, an organization will have one or more employee’s (EDI Team) whose responsibility is to execute unique processes to support the on-going operation of the EDI system. The overall success of the organization’s EDI B2B strategy is dependent on how well the organizations EDI team is able to develop and implement these processes to support the firm’s established business strategy.

The single most important practice that must be established by an organization’s EDI Team is the process used by the team to implement a new EDI transaction set. While every organization that uses EDI to support B2B commerce has been required to develop their own unique methodology for EDI transaction set development, a structured lifecycle listing the tasks required for the successful completion of this critical process is missing from the extensive literature on this technology. This study describes the formal Transactional Set Development Lifecycle (TSDL) that was developed by the EDI Team at a *Fortune 500* food manufacturer. This study also describes how the developed EDI TSDL was integrated into the firm’s traditional organizational Systems Development Lifecycle (SDLC) to ensure the successful completion of the project. Finally, the impact of this new methodology on the firm’s existing business practices is discussed.

MOTIVATION FOR THE PROJECT

The EDI TSDL process described in this paper was developed and formalized purely out of “business necessity” by the members of EDI Team at the company. One of the company’s leading competitors had gained a competitive advantage within the highly competitive retail food supply chain by leveraging the benefits of EDI with key customers. The competitor’s continuous investment in EDI technology had allowed their organization to successfully implement innovative supply chain business practices (e.g., Just-in-Time Inventory Management (JIT), Continuous Replenishment (CR), etc.) that threatened the future profitability of the organization. In attempt to address this emerging competitive advantage, the company was forced to play “technology catch-up.” The organization’s EDI Team was faced with the daunting task of quickly developing and implementing an EDI strategy that would enable the organization to match and exceed the B2B capabilities of their leading competitor. One of the most important components of this new strategy would be the plan advanced by the EDI Team to quickly expand the number of transaction sets that could be exchanged between the company and its top customers. In order for the company to be able to participate in these new supply chain practices – the EDI would be required to develop and implement need for a large number of transaction sets in a short period of time. To address this important challenge, the EDI Team launched a formal initiative to establish and document a process to be used to develop and implement EDI transaction sets efficiently and effectively. This document lists the unique tasks that must be completed by specific members of the IS project team during each phase of the project to successfully develop a new EDI transaction. The result of this initiative was the development of an EDI TSDL.

EDI TRANSACTION SET DEVELOPMENT LIFE CYCLE (EDI TSDL)

Development of the EDI TSDL was guided by the traditional IS SDLC. The ten phases in the EDI TSDL are directly aligned with the major phases that would comprise a typical SDLC. A summary of the major activities that take place in each phase of the TSDL are included in Figure 1. The following sections not only specify the tasks and activities within each phase, but also assign responsibility for activities to specific individuals within an organization.

Pre-Scoping Phase

Once a project has been selected by top management to receive funding for development, the project is officially assigned to a project manager in the organization’s Systems Development Department. It is the project manager’s responsibility to work closely with the project sponsor from the business unit that requested the project (e.g., project user) to establish requirements for the new system and evaluate possible options for meeting these requirements. If the project manager believes that one of the most viable options for the successful completion of the project will require the use of EDI technology, the project manager will contact the EDI project team manager and request that one or more EDI analysts (e.g., team members) be made available to provide EDI consulting support to the project. Once an EDI analyst has been assigned to the project, the EDI analyst will work closely with the project manager to determine if EDI technology can be used to effectively achieve meet the established project requirements. If the EDI analyst,

project manager, and project user concur that the use EDI technology is a possible project solution, these individuals will develop a formal EDI support request consisting of:

- 1) Initial Project Plan: A high-level project plan listing the key project milestones and deliverables. The estimated start dates and completion dates for each phase will be included in the plan.

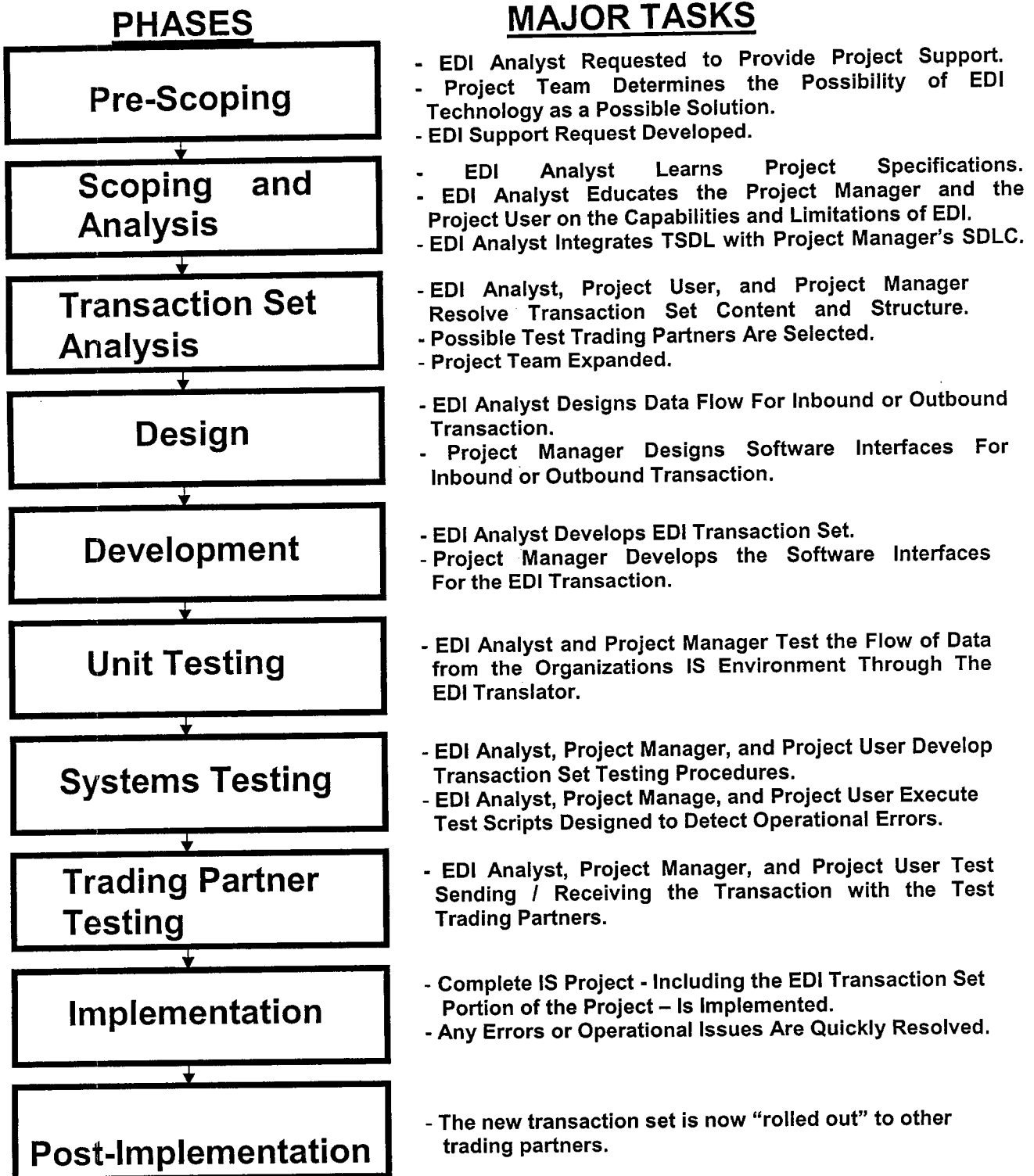


Figure 1: Transaction Set Development Life Cycle

2) EDI Support Request: An overview of the type of support that will be required from the

EDI Team. Support may range from development of a transaction set to the modification of an existing transaction set. This request will include an estimate of the support time required from analysts on the EDI team to complete the project.

It is important to note that in this organization, the EDI team is considered a support function within the organization's Systems Development Department. Since the EDI project team manager and the project manager report to the same supervisor, EDI support for all new systems development efforts can be easily coordinated and managed within the IT department.

Scoping and Analysis Phase

During this stage, the EDI analyst and project manager work closely with the project user to gain a clear understanding of the specific information requirements of the business. Both IS professionals must quickly learn the business operations from the project user so that they are able to assist in the development of the project scope and specifications. While the project manager is responsible for understanding the overall "information" requirements for the project, the EDI analyst focuses only the "information transaction" needs that may arise to meet the project user's business needs. The IS project manager may develop a number of possible IT solutions that will meet the project users requirements. While some of these solutions may require the implementation of an EDI transaction set, others may employ a less sophisticated solution. The role of the EDI analyst in this phase is to serve a project consultant for the project solutions that would require some level of EDI support. In the role of project consultant, it is the responsibility of the EDI analyst to educate both the project user and project manager on the capabilities and limitations of EDI technology in support of the established project scope and specifications. The project manager and the project user must clearly understand the resource requirements (e.g., people, time and money) that will be required to develop of a new EDI transaction set development so that they can accurately assess whether to use EDI to meet the established project requirements. If the project manager and the project user ultimately decide that EDI technology will be required to implement and IS solution that meets the project specifications, the EDI analyst will work closely with the project manager to integrate the remaining tasks of the TSDL into the proposed project development plan. This integration process includes the development of:

1) EDI Phases and Task Estimates: the EDI analyst must estimate the amount of time and people that will be required to support the project based on the preliminary project requirements developed by the project manager and project user.

2) EDI Timeframe: the EDI analyst will establish phase/task start and stop dates, milestones, and deliverables that will coincide with the project manager's overall IS project plan.

NOTE: It is very probable that an IS project may require the development and implementation of more than one EDI transaction set. To simplify the description of the TSDL process, the discussion presented in the remainder of TDSL phases will assume that a single transaction set will be developed to support an IS project.

Transaction Set Analysis Phase

In this phase, the EDI analyst and the project manager complete the preliminary tasks to construct the identified EDI transaction set and then exchange the transaction set with one or more of the organization's valued trading partners. The outcome of this phase is a document stating the intent and usage of the transaction set and the specific data elements. This is the most important phase in the TSDL because it establishes the foundation upon which the rest of the development process is conducted.

First, the EDI analyst will meet with the project user and the project manager to begin the preliminary process of constructing the transaction set. The initial step in this process is a discussion of the typical data elements that can be exchanged with a trading partner using the standardized transaction format established by the two major worldwide EDI standards organizations - ANSI X.12 and EDIFACT. It is the responsibility of the EDI analyst to explain to the project user and project manager the data elements that can be exchanged using a specific transaction set. This provides the project user with the opportunity to identify what information (e.g., data elements) must be exchanged with the organization's trading partners to meet the established project requirements. Once a potential list of data items have been identified by the project user for possible inclusion in the transaction set, the project manager and EDI analyst will work with the project user to identify the location these data items on the organization's existing data storage systems (e.g., data bases, data warehouses, data marts, files, etc.). This task is crucial because the project manager will be responsible for ensuring that all the data elements that may be included in a transaction set are actually available on an existing data storage system. If specific data elements requested by the project user are not currently available, the project manager may have to include the construction and subsequent storage of the missing data elements into his/her project plan.

Next, potential test trading partners are identified. Trading partners are defined to be any business entity with which the firm exchanges documents through EDI. Although these trading partners are typically external to the business operations of the firm (e.g., customers, suppliers), some transaction sets are exchanged with exclusively internal entities (e.g., separate divisions of one company). It is essential that initial test trading partners have extensive experience with EDI. Inexperienced test trading partners can significantly slow down the transaction set testing and implementation phases. It is also highly recommended that these initial test trading partners already have significant practical experience sending or receiving the transaction set that is being developed as part of the project. This is important because trading partners that are currently exchanging a specific transaction will have already developed their own implementation guide for that transaction. The transaction implementation guide is the "road map" that was used by the organization in the construction of the transaction. The guide will typically include such valuable information such as: the EDI standard the organization uses (e.g., X.12 or EDIFACT, or both), data elements included in the transaction, and the format / structure / layout of the data items in the transaction. Finally, potential test trading partners must also be willing to send/receive transactions during the testing phases of the project. Potential trading partners may be identified through several mediums including - the EDI project team manager, general contact with trading partners, surveys of current vendors/customers, and EDI standards controlling agencies. The EDI analyst is responsible for obtaining implementation guides from potential test trading partners.

The project manager, project user, and EDI analyst will then select one to five potential test trading partners based on their EDI experience.

Once the initial structure and content of the transaction set have been identified by the project team and test trading partners have been selected – it is essential that the project team be “expanded” a representatives from any business unit within the organization that may be affected by the implementation of a new transaction set (e.g., information services, legal, auditing). The project user will sponsor a series of meetings with the expanded project team determine the impact the new transaction set will have on existing business operations. The purpose of the first meeting is to explain the basic concepts of EDI and the structure of the transaction set so that there is a consistent level of understanding among all concerned. During the next meetings, the specific intent and content of the transactions sets are discussed. Each segment and data element is reviewed to determine whether it should be included. Current business practices and policies are also reviewed because EDI may change business practices and the way firms view their procedures. In addition, as issues arise during users meetings, an issue owner is assigned to resolve each issue. The project manager documents both the issue resolution and the changes to policies and procedures.

The role of the EDI analyst in these meetings is to facilitate understanding and ensure the contents of the transaction set comply with EDI standards (e.g., syntax, relational conditions, looping structure, etc.) Once the expanded project team has formalized the structure and content of the new transaction set, the EDI analyst will use this information to begin development of the organization’s implementation guide or transaction set application (TSA) document for the new transaction set.

The final task in this phase is providing the organization’s key technical managers with an overview of the impact the new transaction set will have on the firm’s IT infrastructure. The system administrator and the capacity planner are given information about the size of the transaction set; the number of transactions per day; the number of trading partners; and any other information relevant to the capacity required to implement the system. The system administrator and the capacity planner use this information to determine if there is enough disk space to handle the transaction load and enough computer capacity to process the information within the response time required by the application and trading partners. File backup and recovery requirements are also considered at this point.

Design Phase

This phase includes designing the actual transaction specified in the project plan. The design of the transaction set will vary depending on whether the transaction set in an inbound or outbound transaction. An outbound set is one that is transmitted from the firm to an entity outside the firm's boundaries. For this type of transaction set, designs are developed for obtaining data from the database; formatting it into a user defined flat file; transforming it into a standard EDI transaction set; and transmitting it to the trading partner for outbound documents. For inbound transaction sets (data transmitted to the firm from an entity outside its boundaries), designs are developed for receiving the transaction set from the trading partner, formatting the information into a user defined flat file, and disseminating the information into the application database.

The first step in the design phase is to use the TSA document to develop a flat file layout that is compatible with the application and the EDI translator. The EDI analyst and the project manager coordinate this effort to assure correctness and consistency in the documentation, the application database, and the EDI translator. After the flat file layout is designed, the two IS professionals design their own specifications. The EDI analyst is responsible for formulating and designing outbound transaction set specifications ranging from receipt of the flat file to the transmission of the EDI transaction set to the trading partner. For inbound documents, the EDI analyst designs functions ranging from the receipt of the transaction set format from the trading partner to the time it is available in the EDI translator. The EDI translator is the software component of the EDI system that makes data compatible and portable between trading partners.

The project manager is responsible for designing outbound specifications for all functions ranging from application and database development to passing the flat file to the EDI translator. For inbound documents, the project manager is responsible for all functions ranging from obtaining the available documents in the EDI translator to disseminating the information to the proper application database files. The project manager may also write specifications for new applications, changes in existing applications, new tables for the application database, and changes made to existing database tables. In essence, the project manager is responsible for the activities of the traditional SDLC and for ensuring that the EDI analyst has the information required to incorporate EDI into the overall project. A series of “walk-throughs” are conducted throughout this phase to ensure that there is a seamless integration of the EDI portion of the project with the over all project design. These involve technical, user, and IS representatives to ensure overall compliance with internal standards and preferred business practices.

Development Phase

The purpose of this phase is to execute the specifications developed during the design phase. The major responsibilities of the EDI analyst and project manager are to oversee the development of the application, flat files, maps, and the project as a whole. Any changes to the original time and resource schedule must be immediately and effectively communicated to these two people, management, and other concerned parties.

Changes to the design specifications are likely to occur, and depending on the degree of change, different steps may need to be taken. Major changes may require further meetings with the business areas, whereas minor changes may only require a consensus between the EDI analyst and the project analysts. However, regardless of the degree of change, results must be documented so that they can be incorporated throughout the rest of the lifecycle. Periodic status meetings are held throughout the development phase to facilitate communication of issues and schedule changes and to maintain continuity.

Unit Testing Phase

In this phase, each function incorporated in the development phase is examined to ensure completeness, accuracy, and consistency with the design specifications. The EDI analyst is responsible for testing all aspects of the translator map, partner files, communications with the trading partner, and other EDI related functions defined during the design phase. The project manager is responsible for testing the flat file interface program and other application related

functions. As many scenarios as possible within the application and EDI processes are tested. Test scripts are written to document the scenarios tested and results expected. Any deviations from the expected results are corrected before moving to the next phase.

Internal Testing/System Testing Phase

The integration of the flat file between the application and the EDI process is verified in this phase. All scenarios tested in the unit testing phase must again be tested to assess the integration of the applications and EDI processes. The test scripts used in the unit testing phase can also be used in this phase. The goal is to ensure that the EDI functions and the application are properly integrated. Any deviations from the expected results are corrected before moving to the next phase.

Trading Partner Testing Phase

The purpose of this phase is to test the EDI transaction set for compliance with EDI standards and for acceptability to external trading partners. The EDI analyst will coordinate test procedures with representatives from the test trading partners. A series of transaction sets are transmitted to the trading partner that includes functions and scenarios encountered in a production state. Feedback from the test trading partners regarding each testing scenario is typically provided to the EDI analyst. It is the EDI analyst's responsibility to identify and resolve any of issues that arise during this phase of the lifecycle. Again, major issues must be resolved prior to moving to the next phase.

A variety of methods can be used in trading partner tests. The best is to parallel an existing process. If the trading partner is receiving a paper document, for example, and the EDI transaction set is replacing this document - then a parallel test over a period of time, comparing the paper process with the EDI transaction set process typically provides the best evidence of whether the transaction set is efficient. Again, a variety of scenarios must be tested, and the test scripts devised in earlier phases may be used. If "paralleling" an existing function is not possible or feasible, then the trading partner and the firm determine the appropriate testing procedures and the extent of testing required in order to assure both parties that the transaction set structure and content is acceptable.

Implementation Phase

The purpose of this phase is to put the policies, procedures, and applications into operation. Items such as programs, maps, and screens are turned over to the computer production area. This process follows normal IS procedures for implementation (e.g., walkthrough, turnover procedures). Policy and procedure changes identified throughout the lifecycle are also implemented. This phase also addresses any necessary training for users, and computer operations staff.

Post-Implementation and Rollout

Additional trading partners may be brought in after the initial test trading partners are on-line and the system appears to be functioning properly. This is called the rollout. Project users establish the selection criterion for the addition of new trading partners with some help from the EDI

analyst. When bringing in a new trading partner, it is essential the EDI analyst receive an implementation guide from the new partner. This document is used to compare the EDI and application functions with what is expected by the trading partner. When differences occur, the necessity and feasibility of the new expectations must be discussed.

ORGANIZATIONAL IMPACT OF THE TSDL

The benefits resulting from explosion of new transactions were seen almost immediately. Customers and suppliers began to approach the organization about performing pilot projects using these transactions, thereby allowing the firm to build close working relationships with some of its biggest customers. By helping to solidify key business partnerships, the firm was able to lockout competition and gain a competitive advantage in their competitive marketplace. In addition, these projects helped support the firm's commitment to implementing and supporting new business processes such as JIT and Continuous Replenishment. As a result, the organization became recognized as a leader in the use of technology to support new business processes.

Despite major benefits realized, several problems arose out of the introduction of a standard EDI TSDL. Although many problems of using EDI technology were solved, a number of new problems and challenges surfaced. Because the TSDL had been developed and implemented quickly under strict time constraints, a number of important factors were not incorporated into the implementation process. First, not enough time was given to training and educating the individuals required to participate in the TSDL. Even though an attempt was made to provide some level of training, most was on-the-job training. There was a steep learning curve that impeded progress at first, but participants did learn surprisingly quickly. Projects began to run more efficiently as members gained experience with the TSDL.

Another issue that arose was that the unit in which the EDI team resided took few formal steps toward ensuring user acceptance of the new TSDL. Thus, some users continued to follow the historical informal process, and others, failing to understand their own role in the TSDL, viewed the development process as the sole responsibility of the EDI staff. The former group simply refused to use the TSDL and pursued their own development style, whereas the latter group stopped participating in development altogether. This resulted in costly delays in some projects and rendered others useless.

The final issue was that not enough thought was given to the cultural impact EDI technology had on the organization's current business processes. EDI, by its very nature, is a process re-engineering technology. Failure to recognize and plan for business process changes that EDI creates can degrade performance, and in a worse case scenario, can halt operations. EDI affects organizational structure as well as staff roles and responsibilities. For example, consider customer orders. In a traditional process, the customer service area may have clerks who take faxed or verbal telephone orders from customers, validate the order data and customer credit, enter the correct information into a computerized order processing system, and resolve any problems that may arise from the placement of the order. In the EDI order processing environment, the process is streamlined. Many tasks that were completed by the clerks are now automatically completed by EDI. Thus, the process changes to accommodate EDI, and the roles and responsibilities of the clerks must change accordingly. In an effort to rush the transaction

sets into production, this part of the process was often skipped or glossed over. The effectiveness of the transaction set was often limited until the functional unit could make the necessary changes to both their structure and the roles and responsibilities of the individuals within that structure. As is often the case, these changes were met with resistance by some functional area groups.

CONCLUSION

This purpose of this case study was to describe the Transaction Set Development Lifecycle (TDSL) that was developed by the EDI Project Team at the *Fortune 500* food manufacturing firm. This paper outlines the specific phases and tasks that were established by the EDI Project Team in their TDSL to align with the activities taking place in a typical Systems Development Lifecycle (SDLC) project. The specific responsibilities of the key members of the project team are delineated in each phase of the TDSL. Finally, this study describes the benefits and challenges that were associated with the implementation of EDI within the organization.

The documented results from this study should be of great interest to organizations that are currently looking to expand the number of transaction sets they exchange with their key trading partners, or organizations looking to adopt and implement this core B2B technology.

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