

Merging EDI With JIT: The Impact On U.S. Manufacturing

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Abstract

Electronic data interchange (EDI) has brought numerous benefits to users with its ability of instantaneous information transfer. An emerging issue has been the impact of EDI on the U.S. manufacturing industry which has been implementing just-in-time (JIT) manufacturing at a growing rate. As EDI compliments JIT objectives it is changing the way many companies are doing business. This paper addresses the advantages, limitations and future impact of this powerful combination. Further, a model of information flow in an ideal EDI/JIT system is presented and organizational factors critical for successful development and implementation are identified.

Introduction

Just-in-time manufacturing has been implemented by a number of U.S. firms in recent years and has served as a great boost in revitalizing the U.S. manufacturing base. To help achieve full benefits of JIT, numerous companies are employing a communication technology called electronic data interchange (EDI). The merging of JIT with EDI has brought unprecedented benefits to users, particularly with an increase in the use of international sourcing and a rise in the number of multinational organizations. This paper explores the advantages and limitations of this powerful combination, as well as the future impact on American industry. Further, a model of information flow in an ideal EDI/JIT system is presented and critical success factors are identified.

The basic tenet of JIT is the elimination of waste. This includes all materials, equipment, inventories and labor in excess of what is needed for immediate production. JIT requires the production of just the right quantities at the right time. The prerequisite for this is a close working relationship between customer and supplier and an efficient method of information transfer between the two. EDI enables companies to instantaneously transfer and share information relevant for production planning and can significantly help management meet JIT objectives. Consequently, EDI has been adopted by a number of JIT manufacturers and suppliers.

EDI users claim a number of benefits including significant reduction in inventories, improved quality and efficient production scheduling. Despite many implementation problems that remain unresolved, such as issues of security and liability, the number of EDI users continues to grow exponentially. As EDI makes JIT easier to implement, this growth promises an increase in the number of companies venturing to adopt JIT.

Electronic Data Interchange (EDI)

Electronic Data Interchange (EDI) is the electronic exchange of information, documents and business transactions between computers. The information typically transmitted are standard business documents including purchase orders, shipping and freight invoices, bills of lading and arrival notices. In addition to the exchange of standard documents, leading manufacturing firms are exchanging information such as production and material requirements schedules, supplier's advance shipping notices and quality information.

There are many advantages to using EDI over a traditional paper exchange environment. As the exchange of information is electronic the transactions are instantaneous. Consequently, the processing and handling of paper, as well as the inputting of data are eliminated. Because there is no rekeying of data, the chances of errors have been significantly decreased resulting in improved quality and consistency, as well as decreased time spent on auditing and tracing errors. Further, the procurement cycle has been shortened, as many companies are expanding their EDI functions to include a transfer of funds.

Coupling EDI with current bar coding technology, companies can track inventory from point-of-sale and automate the entry of identification and location data into data systems. Other EDI benefits include lower overhead cost due to a reduction in clerical cost, paper flow, mail and telephone expense, as well as file space.

Although EDI technology has been available since the late 1960's, the widespread use in industry has been a recent trend. Its use has been made feasible due to decreased cost in supporting software and hardware. EDI can be added on to an existing computer system and hooked up directly to a supplier. Further, 'off the shelf' software is available to support standards and protocols used by JIT manufacturers.

Combining EDI With JIT

The merging of EDI with JIT can be a significant factor in enabling companies to achieve manufacturing excellence and meet the competitive challenge of world markets. EDI compliments JIT management objectives of eliminating inventories and waste. The efficient exchange of information with suppliers with regard to material receipts, schedule changes, and quality problems can create a highly effective JIT system. In addition, setting up an integrated system contributes to a close working relationship between supplier and customer.

One of the greatest benefits of EDI to manufacturers has been a reduction in production inventories, as shippers are able to use information from the EDI system to coordinate shipping schedules. Coordination of shipping schedules enables goods to be delivered to the manufacturer when they are needed. Production efficiency has increased due to shortened lead times and timely and accurate material requirement schedules.

According to Stevens (1988), EDI enables JIT manufacturers to generate daily or even hourly shipping schedules. This type of scheduling would be accomplished with great difficulty in a traditional paper environment. Further, EDI can be used to send purchase orders and receive information as to when parts will arrive, both for production and nonproduction items such as machine parts.

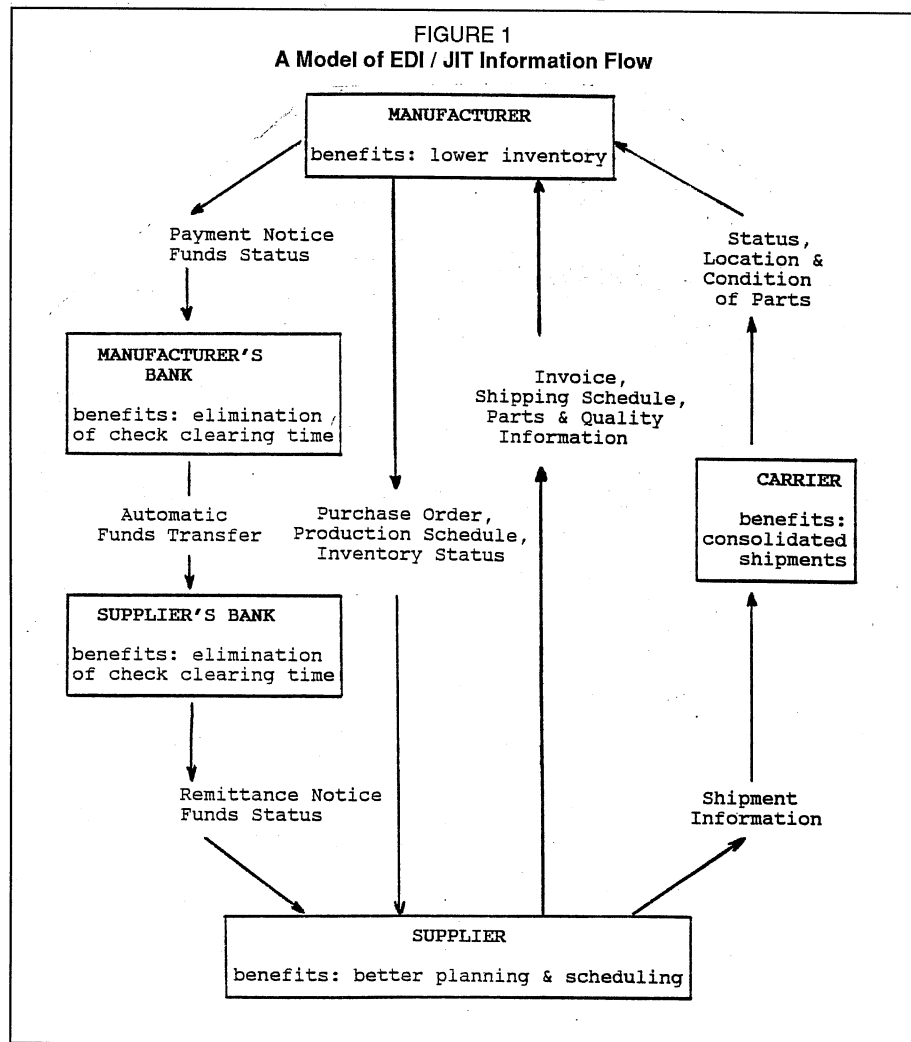
Another feature of EDI that has much potential is its ability to provide electronic tracing of material movement. This enables manufacturers to track the status, location and condition of an order as it moves from the supplier's loading dock to the JIT manufacturing plant, easing production planning and scheduling. In addition, EDI can provide the manufacturing manager with the status of any product going through the production process, providing for more efficient materials management.

EDI has had a strong impact on other aspects of JIT, such as quality and purchasing. Quality has improved, as rekeying of data has been eliminated resulting in fewer mistakes in shipped quantities. According to Vickery (1989), some companies are even receiving quality data on purchased items from

suppliers before items are actually shipped. Purchasing has been affected as EDI has enabled supplier analysis reports to be generated by scanning the computers of suppliers for lowest bids and consistent quality.

A Model of EDI/JIT Information Flow

Figure 1 shows a model of EDI/JIT information flow and benefits derived to each of the system members. In an ideal EDI/JIT procurement cycle no paper is exchanged. Unlike the traditional purchasing process, the replenishment orders from a manufacturer are written to a computer file and forwarded to a supplier's computer. As soon as the order is received the supplier electronically transmits an acknowledgment to the manufacturer, as well as packing information to their warehouse and to the transportation company. The supplier produces the invoice in the form of a computer file and sends it to the manufacturer. Once the shipment is in transit the location of an order can be ascertained at any moment. Finally, the manufacturer pays the bills using electronic funds transfer (EFT) through a bank clearing system which sends the remittance advice through the computer.



For the system to work the manufacturer and supplier need to form a long-term partnership. The supplier needs to be able to deliver smaller orders more frequently and provide specific shipping and packing information to the manufacturer. The manufacturer can no longer accept short-shipments. On the other hand, the supplier can no longer allow the manufacturer to make last minute substitutions on orders. The focus of the partnership is on stabilizing the system so these practices are no longer necessary. Through the enhanced communication process the production systems of the manufacturer and supplier should be synchronized so that the entire system can respond faster to changes in market demands.

Criteria for Successful Implementation

The successful development of an EDI/JIT system begins with top management support and broad based support of key functional managers whose areas will be significantly impacted by the EDI/JIT program, e.g. accounting, purchasing, information systems and materials management. To successfully implement EDI/JIT, it is critical that management support be strong enough to overcome any organizational barriers to change. Further, the program requires long-term, manufacturer-supplier partnerships which can only be supported by the upper management of all firms involved.

Another critical aspect for a project of this magnitude, which will entail company-wide changes in policies and practices, is the use of a formalized cost-benefit analysis. Large amounts of resources will be committed for the purchase and installation of equipment needed for storing, processing and transmitting of data. All costs and benefits should be identified and listed in a before and after EDI comparison. According to Monczka and Carter (1988), one way to classify the various cost and benefit categories is as either one-time fixed development costs or variable ongoing system operating costs.

To prepare for successful implementation, the EDI/JIT program must have clear leadership. An important factor used successfully by companies is the team approach with regular meetings of personnel representing every discipline in the company to meet and coordinate the project (Milbrandt, 1990). Monczka and Carter (1988) recommend the development of a steering committee made up of higher level personnel from all disciplines.

Regardless of the type of leadership selected, the critical factor is to assign full-time people to the project who are not given any other duties that can interfere with the task at hand. These individuals should be responsible for deciding on a corporate strategy and developing long term goals for expanding EDI/JIT in a consistent manner throughout the company. Also, decisions will have to be made with regard to selecting specific EDI/JIT hardware

and software, and setting standards for specific applications. For technical aspects of these issues, it is helpful for organizations to consult an independent technical expert.

An EDI/JIT system is most easily implemented in stages, beginning with a pilot program designed to get the "bugs" out of the system. An important decision is the selection of suppliers that should be brought in to the EDI/JIT system first. As supplier support is critical for success of the program, suppliers need to be convinced of the program benefits from the onset. As the program develops, suppliers should be kept informed about the progress through regular supplier conferences.

Finally, to insure success of the program, two additional success factors should be addressed by top management. The first is the provision of EDI/JIT employee training. The greater the number of people that understand the process, the greater the chances are for success. The second is a change in the reward system which should consider employee contributions to the EDI/JIT effort. Some factors which could be included are contributions to waste reduction, innovations, as well as improvements in customer service. This would help integrate the philosophies of EDI/JIT into the organization's daily activities.

Companies Combining The Use Of EDI With JIT

One of the largest users of EDI in combination with JIT are the three major U.S. automakers. According to Sadhwani and Sarhan (1987), GM has a number of plants that utilize EDI to communicate with suppliers and other divisions, electronically exchanging information such as material releases, purchase orders and invoices. Further, GM has plans to introduce electronic payment of invoices and transfer of funds. Ford uses an electronic "mailbox" for exchange of invoices for production and nonproduction parts, as well as purchase orders and requests. Finally, the Chrysler corporation claims savings by using EDI in dealing with suppliers, enabling them to notify suppliers of last minute changes in schedules as well as overshipping conditions.

The use of EDI and JIT by many manufacturers has forced their suppliers to utilize the same systems. For example, according to Sadhwani and Sarhan (1987), AutoCon, an Ohio based public warehouse, handles just-in-time storage of various parts for GM. It is required to ship parts to GM's assembly plant in strict adherence to JIT production schedules and may be required to ship parts within 15 minutes of receipt from suppliers. This is made possible using a computerized system mounted onto a forklift at AutoCon from which information about arrival of various parts is transmitted to the GM computer. This system allows the forklift operator to electronically communicate with GM's production managers and receive instructions on what to do with various shipments.

According to Canna (1988), Union Carbide, one of the U.S.'s largest shippers, is currently using EDI for all export transactions between shipper, forwarder and carrier. UC's international transportation department has an EDI set up with all of its freight forwarders and ocean carriers. The decision to set up this information link evolved from industry pressure to implement an EDI system. UC's goal is to develop a completely paperless system from order entry to freight payment. Further, EDI will enable tracing of shipments. As EDI greatly speeds up information flow and expedites the release of documentation to customers around the world, UC believes that EDI capability will count heavily in the future as a carrier selection criteria.

EDI has been in use by other manufacturers and industries. For example, the Navistar Corporation uses a JIT system and is electronically linked to its suppliers. It is able to have some materials delivered only four hours before they are needed for processing. According to Sadhwani and Sarhan (1987), Navistar claims to have reduced inventories by 80 million just during the first year of having the EDI system in operation.

Many organizations are turning to international sourcing due to cost and quality considerations. According to Vickery (1988), Magnetic Peripherals, Inc., a manufacturer of electronic components utilizes a JIT system in conjunction with its MRP system. Though located in Oklahoma City, MPI uses sourcing from Hong Kong, Japan, Taiwan and Mexico. To provide more efficient coordination, MPI is instituting an EDI program with two of its suppliers in Taiwan. The goal is for MPI to receive quality data on purchased items before they are shipped.

Problems And Limitations

As with the implementation of any new technology a number of issues still need to be resolved. One of the greatest problems lie with the issues of security and liability. As the information passed in an EDI system is highly proprietary, adequate security controls must be in place to prevent unauthorized access to the system. Further, as information is electronically passed the question of who is liable for order entry and software errors remains. Most lawyers are not familiar with EDI and contract law is slowly expanding to address critical issues that may arise.

Other legal issues relate to implementing an EDI link, which requires many data formatting agreements between trading partners. Problems arise when negotiating EDI trading partner agreements which can be a drawn-out process. According to Eckerson (1990) managers want agreements to protect their company against disputes and lawsuits, but often hesitate to call in lawyers out of fear that the process will hinder efforts to convert partners to EDI.

As companies are eager to implement an EDI system, many are doing so without an informed understanding of

true costs and benefits. Consequently, results may not reap the benefits expected. According to Monczka and Carter (1988), recent research on EDI implementation suggest that sufficient analysis and planning, as well as support during design and operations are important elements for a successful system.

The greatest benefits of EDI are accrued by industry leaders which tend to reap strategic advantages. However, there are a number of companies forced to adopt EDI in order to accommodate EDI leaders and remain viable. For example, as major manufacturers run most of their trade transactions over EDI networks they actively encourage their suppliers to transmit documents electronically. According to Belitsos (1988), these EDI followers frequently face large upfront costs that are not offset by a sufficient volume needed to make EDI cost effective.

Other EDI problems are developing as more companies are using EDI's capability of electronic transfer of funds. One controversial issue is the elimination of float, the use of money between the time the check is mailed and cashed. Further, as this feature enables companies to pay bills instantaneously, advantages of quantity discounts may be eliminated.

Finally, as with any rapidly developing technology, EDI's capabilities are growing and changing. The problem has been for companies that implemented EDI technology five to ten years ago and are being left behind. These EDI pioneers frequently have incompatible software and hardware between different operating units. As such, they have great difficulty in merging the various EDI programs into a unified system. For example, according to Eckerson (1990), Mazda Motor Corp., recently implemented a complete EDI system that supports all functions, including electronic funds transfer. On the other hand, GM, which has had EDI support for many years, is reportedly having difficulty in tying together its EDI systems.

Implications For The Future

EDI's growth is inevitable, as more non-EDI documents are converted into EDI standard formats. Replacing the paper copy of purchase orders with electronic communication is just the beginning of EDI capabilities. The nature of the EDI function itself is expanding. For example, EDI can be used to better analyze what is selling at the stores. The store buyers have a lot more flexibility and greater ability to make decisions based on accurate and timely information. Also, EDI provides the ability to be more flexible with inventory. The cost savings from lower inventories can be applied to carrying a wider variety of inventories.

Many companies are pushing for extensions to EDI in order for technical documents and drawings to also be electronically transmitted. For example, manufacturer

orders for subassembly components are typically preceded by design and specification inquiries to engineering companies. According to Tyler (1990) this drawn-out process could be significantly shortened by using EDI as part of the computer-aided design system. Some companies, such as General Electric and Supply Tech, Inc. have each developed their own methods of transmitting this type of information along with the EDI documents, though no standard method has yet to be established (Ponting, 1988).

As the paperless business rapidly evolves and the computer becomes a pervasive and indispensable tool, employee qualifications will need to change as well. Basic computer knowledge will become essential for all employees. Further, this will mean a requirement for regular employee on-the-job training and a necessity for managers to keep up to date on current developments in computer and communication technology. Finally, the automation of company transactions and communication systems creates an increased threat of white-collar crime. Regular security checkups will be a necessity, as well as the development of sophisticated security measures.

Conclusion

According to Rochester (1989), there are as many as 10,000 companies actively engaged in EDI communication with suppliers and customers, with the number of users growing at an estimated rate of 147% per year. This growth will continue as many companies are pushed into using EDI in order to remain competitive. As EDI's logic supports JIT and an integrated manufacturing system, an increase in the number of companies using some form of JIT should be expected. This is supported by a study designed to assess the cost savings accrued to current EDI users (Carter and Fredendall, 1990). Findings show that the most significant savings occurred in the areas of reduced paper work, data input errors, inventories and lead times. Improvement in these four areas is the basis for JIT implementation.

As EDI bridges time and distance the concept of JIT will extend to many organizational functions. EDI technology has matured to the point of becoming a common way of conducting business in many places around the world. In the 1990s, EDI promises to become just another information systems tool.

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