

INPUT

STRATEGIC MARKET PERSPECTIVE

Electronic Commerce and Manufacturing

Electronic Commerce Program

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Electronic Commerce and Manufacturing

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Electronic Commerce and Manufacturing

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Abstract

The U.S. corporate environment has continued to change over recent years with the implementation of increasingly effective reorganizational processes. Manufacturing, being one of the largest industry sectors, has been dramatically influenced and has become a major recipient of Electronic Commerce products and services.

In this report, *Electronic Commerce and Manufacturing*, the manufacturing trading community, Electronic Commerce products and services sold into that community and issues surrounding this period of massive organizational change, are described.

Despite relatively small revenues for Electronic Commerce vendors into this major market, these products and services are becoming increasingly strategic to cost-conscious companies and whole trading communities in the process of changing their traditional ways of doing business. The use of the Internet by consumers has also broadened the general knowledge of and interest in specific networking applications and this, combined with the acceptance of re-engineering has captured the attention of corporate decision makers.

The report goes on to describe the needs of the manufacturing community for Electronic Commerce products and services; who the major players are in this market, major vendors, and keys to success in penetrating this market. Changes in the makeup of the Electronic Commerce vendor community are described as are new distribution channels.

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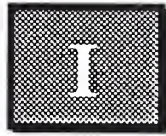
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Introduction

A

Purpose of This Report

The purpose of *Electronic Commerce and Manufacturing* is to describe today's manufacturing trading community in which electronic commerce (EC) products are being implemented. The manufacturing industry sector described in great detail in other INPUT reports is defined here as discrete and process manufacturing. Relevant details of those definitions will be described later.

Overall, this report will help the reader understand changes in the Manufacturing Electronic Commerce marketplace, with focus on EDI. Changes in the EDI marketplace are described, including future trends toward open systems environments. Market forecasts for the information services manufacturing marketplace and EC are described and relevant vendors profiled. Conclusions are drawn regarding changes in the manufacturing environment and the role EDI will play in that environment.

B

Definitions

Following are basic definitions used for discrete and process manufacturing, as well as EC.

A *discrete operation* is defined by following the form of the material used at the beginning of the manufacturing process and noting if its form has changed after use. It is assumed that a purely discrete operation is one of assembly. If the material cannot be brought back to its original form then a process has occurred to change it. A *process operation* then, is most easily defined by identifying the form of the material used at the

beginning of the operation and its form after use. If the material changes form during production and cannot be uniquely identified in the end product then a process operation has occurred.

Process Manufacturing industries which had the largest volume of shipments in 1993 includes food products, petroleum, rubber and plastic products, steel mill products, industrial chemicals, lumber and wood products, beverages, soaps and toilet preparations.

In the discrete area, those product areas that are the fastest growing include semiconductors, surgical and medical instruments, surgical appliances and supplies, computers and peripherals, electromedical equipment, motor vehicle and car bodies, household laundry equipment, household refrigerators and freezers, auto parts and accessories and x-ray apparatus and tubes. These areas fall within the Standard Industrial Classification (SIC) manufacturing codes established by the U.S. Department of Commerce and are used by INPUT in its definitions of industry sectors. See Appendix A for details.

Total information services within manufacturing are defined by INPUT as growing at an annual growth rate of 14%, thus, having considerable impact on this sector. INPUT analyzes information services by product/service category including application software products, network/electronic information systems, processing services, turnkey systems, professional services, global change outsourcing and systems integration.

Electronic commerce, defined by INPUT as "the use of electronic network systems in order to conduct business transactions" is embedded within the Network Services Market. Network Services is the fastest growing submarket in the information services model, expected to grow 21% annually through 1998, tripling the market from \$130 million in 1993 to \$335 million in 1998. The largest revenue contribution to network services will come from expansion of EDI services and applications. There will continue to be intra-company need for large companies with many locations that create core facilities that rely on information from other locations. There will also be increased vendor and customer communication assets to manage as users build partnerships and share more information.

This report integrates the concepts found in other INPUT discrete and process manufacturing reports with an understanding of network services—in particular, EC.

C

Report Methodology

Much of the data used in this report was derived from user and vendor surveys as part of INPUT's ongoing market analysis program. Discussions regarding discrete and process manufacturing were based on work found in other INPUT studies:

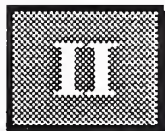
- *Discrete Manufacturing Markets 1994-1999*
- *Process Manufacturing Markets 1994-1999*
- *Network Services Markets 1994-1999*
- *Wireless Communication Opportunities*

Trends, market sizes and growth rates are based upon INPUT research and in-depth interviews with users, the manufacturing industry and the information services vendors serving the industry. Review of EC vendors was also conducted. INPUT maintains ongoing relationships with all users and vendors it interviews. It also maintains extensive vendor files and interview databases.

Extensive use was made of INPUT's corporate library located in Mountain View, California. The resources in this library include on-line periodical databases, subscriptions to a broad range of computer and general business periodicals, continually-updated files on more than 3,000 information services vendors and the most up-to-date U.S. Department of Commerce publications on industry statistics.

Note: When displaying market forecast values in bar and column charts, INPUT rounds these amounts for ease of visual reference. Relevant figures are rounded to the nearest tens of hundreds, thousands, millions or billions.

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Executive Overview

A

Manufacturing Industry Overview

Manufacturing is one of the largest and most ubiquitous industry sectors in terms of annual revenues and in its impact on the U.S. and world economy. For that reason it is one industry sector into which most EDI vendors sell their services and software.

The U.S. Department of Commerce measures and forecasts growth for approximately 150 manufacturing industries and groups. From 1973 to 1988 computers and semiconductors were the fastest growing manufacturing sector. Since 1988 until today, the fastest growth has occurred in health care equipment industries. These are cyclical manufacturing sectors in which patterns in growth tend to repeat themselves. We can expect technology manufacturing to again be dominant in the services (nonmanufacturing sector). High-tech services have had the strongest growth since 1987 and are expected to continue. High-tech manufacturing in the health area has also steadily grown.

INPUT's view of the industry positions EDI software and services within "Network Services" products/services. Network Services expenditures have accounted for approximately 8% of the total U.S. Information Services market as measured by INPUT. This sector's revenues were \$11.9 billion in 1993 and are expected to grow 17% to \$26.5 billion by 1998.

Network Services are further subdivided into Network Applications (including communications products like EDI, Electronic Mail, payment systems, workflow, etc.) and Electronic Information Services (i.e., databases).

B

Manufacturing Information Services Market

1. Total Market Size

Information Services revenues in both manufacturing sectors were \$21.9 billion in 1993 and are projected to grow to \$41.8 billion in 1998 at a 14% compound annual growth rate (CAGR). Discrete manufacturing accounted for 67% of this total but discrete and process manufacturing will grow at this same rate.

Combined, the two manufacturing sectors accounted for the largest spending on information services with Banking and Finance (\$14.6 billion) and Federal Government (\$11.2 billion) sectors having the second and third highest levels of spending.

2. Network Services Submarket

The Information Services market as defined by INPUT consists of fifteen industry sectors and eight products/services, with network services (one of the eight markets) within manufacturing being the focus of this report.

In 1993, network services revenues in manufacturing were \$1.2 billion and are expected to grow to \$2.6 billion by 1998 with a 19% CAGR.

The network applications portion of network services accounted for \$230 million in 1993 and is expected to grow about 25%, to approximately \$710 million by 1998.

In short, the software, data communications and support services we call electronic commerce (EC), plus the contents of commercial electronic databases—a market worth more than \$2 billion in 1993—is expected to grow to almost \$6 billion by 1998. Manufacturing accounts for 10-12% of that market.

C

Electronic Commerce Market Opportunities in Manufacturing**1. General Information Services Needs**

U.S. manufacturing, an industry with far reaching presence in the U.S. and world economies, will continue to have a growing impact on the information services industry. The recent worldwide economic downturn has triggered organizational changes throughout manufacturing areas. Trends toward downsizing and quality improvements within manufacturing will continue despite some improvements in the overall economy.

Organizational changes driven by process re-engineering will have a far-reaching impact on growth and productivity. Improvements such as these will spur on the processes of re-engineering which, in some instances, are in their infancy, as corporations, vendors and consultants continue to learn and implement these processes.

New approaches to processing information as well as storing and moving information will continue to impact manufacturing with applications such as EDI playing a large role. The existence of EDI technologies will not trigger any major changes. EDI has existed for more than 20 years and has slowly been implemented across most industry segments.

Rather, EDI improvements—increased use of graphical user interfaces, greater sophistication in translation and mapping software, more thorough and available customer services, expanded platform availability and other improvements—are occurring as industry users are seeking more effective solutions to their re-engineering problems.

2. User Requirements and Analysis

Users in the manufacturing sector are expanding their interest in EC products. The use of the Internet by consumers has broadened the general knowledge of and interest in specific networking applications and this, combined with the acceptance of re-engineering, has captured the attention of EC vendors.

The EDI vendor community is bustling with new products to meet the perceived needs of users, especially for the following:

- High quality translation products
- Fully functional mapping, providing easily integrated business process applications
- Graphical user interfaces on products
- Extensive user training, education and custom consulting needed to bring up trading partners

EDI-oriented consulting, education and customer service are expected by customers. EDI has historically required intense efforts to implement. Customer service is not an optional offering for vendors and therefore is no longer a differentiator at the high end. Rather, GUI presentation and transparent technology—to the extent possible—are becoming the differentiators.

3. Keys to Success in Penetrating Electronic Commerce Markets

Penetration of EC markets (including EDI, Electronic Mail, Payment Systems, Workflow, etc.), is not a simple issue in today's market. Groups of vendors have been providing these services for up to 25 years and are very proud of their depth of knowledge and expertise. Some adapt to the environment by electing to expand beyond their current markets while others chose to serve the same set of customers they have always serviced (especially true in some industry-specific EDI vendors).

New entrants are appearing which provide upgrades on technologies: UNIX-based EDI products, EDI for client-server architectures and other platform-specific products, EDI via Lotus Notes and other attempts to provide EDI functionality along with EDI integrated with other EC products such as E-mail. These new entrants may simply fill holes left by software providers who have left the market due to acquisition or lack of customers. Others may be viable alternatives to traditional EDI methods, and well-established vendors need to take heed.

A special set of vendors—the traditional telecom companies—may also become more important for EC. Having very large product

portfolios ranging from voice communication switches to data applications like EDI, the revenues from EDI are fairly insignificant overall. Therefore, a general lack of corporate concern for product lines generating relatively few revenues may create problems internally—supporting, producing and servicing EDI program developments.

However, traditional vendors have been in the marketplace for a long time and have a very real sense of what is required to develop EDI and related products.

As time progresses and customers continue to ask for these products—presumably because of the strategic nature of EC—telecommunication companies will improve quality, service, reliability and consistency of these offerings. They certainly have the resources to do so.

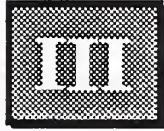
4. Future Distribution

Changes in the EDI market could effect future distribution of EDI:

- From software vendors (TSI, ATI; Delrina Forms, General Magic Telescript; Novell's Univell, Microsoft NT) to resellers at large and small companies. Examples of large companies would be Wal-Mart, JC Penney, Levi Strauss, Alan Bradley and LSI Logic.
- Distribution may also go from systems integrators (EDS, TI, Informix, Access Systems Software) to large companies and small companies. Future distribution will continue to involve industry-specific service providers to large and small companies and from software vendors to large companies which then distribute to small companies via their traditional hub and spoke routes.
- Finally, distribution of EDI may take the form of mass market PC applications and users who own their own systems, to small companies for horizontal application solutions. Exhibit IV-8 captures what could be the distribution pattern of the future.

Opportunities, therefore, exist in all groups:

- Traditional EDI vendors—to expand the number of users of their services and products as EDI becomes more generally understood; to upgrade their technologies, begin putting the technical complications into the background or make their products more user friendly.
- New Entrants—to develop new ways to provide EDI functionality which will be consistent with today's interest in client-server architectures, and open systems; the Internet and its dramatic expansion of networking to "the masses"; creative ways to do traditional EDI in a more user-friendly environment and to meet traditional vendors head on.
- Telecom EDI providers—to improve quality, consistency, reliability and service in products and services that have well-established customer bases, are supported by deep-pocket telecom companies, and are requested by customers as strategic to their re-engineering processes. These have the greatest potential to derive great benefits from the current positive market for EDI.



The Corporate Environment: EC and Manufacturing

A Manufacturing and Electronic Commerce

1. A Changing World, A New Corporate Environment

Economic events in recent years have created two climates, one depressing and one somewhat better in terms of strength of U.S. financial markets. During the downturn, large companies have begun to look for ways to cut costs. They have done this through a variety of methods, but for many, reorganization of their business practices has been in order.

These events have resulted in a trend toward downsizing or changing corporate approaches to processing, storing and moving information. Integral to this trend is the need to cut costs, but as we know, downsizing can be an activity requiring substantial investment. Therefore, decisions to scale down an organization by reorganizing its information flow and communication architectures, etc., have become critical strategic decisions and often costly ones requiring detailed cost benefit analyses.

The choice to invest in downsizing and restructuring (from a technical perspective—re-engineering communications networks and information systems) has become a positive one as the economic picture improves. Those companies deciding to make such investments, though implementation is not complete in many cases, can begin to see the light in terms of the benefits they are financially accruing from their investments. The current economic situation can only stimulate the interest in companies engaging in re-engineering their information systems architectures or downsizing their corporations.

In general, high-end companies are in a better position to make these kinds of changes, but similar decisions will be made by mid-range to low-end firms until, eventually, efficient systems are in place marketwide. This is not unlike the local-area network (LAN) phenomenon of the last seven to ten years.

In addition to re-engineering and corporate downsizing, regulatory events of recent years have had an impact on the manufacturing industry and, in a unique way, have affected the trend toward quality. In earlier INPUT reports, regulatory impacts in the manufacturing area were described as promoting a trend toward self-regulation.

In order to sell to many larger companies, it is increasingly necessary to demonstrate a willingness to implement new total quality management practices. Suppliers as well as customers make such demands. Companies such as Ford, Motorola and U.S. West require such programs and often require, by contract, that a vendor apply for the Baldrige Award.

The entire European community will often require conformance to ISO 9000 standards for companies to compete. The levels of performance required to meet expectations will force more and more companies to re-engineer and incorporate more total quality management principles leading to a greater use of business process automation.

In general, the environment for manufacturing in EDI has been one of positive change focusing on the restructuring of information architectures inside the company with an improved re-emphasis on quality, necessitating an internal sense of self-regulation by the industries involved.

In addition to this, INPUT continues to see a proliferation of computing across all business functions and a trend toward network management systems which enable users other than engineers to take control of network information flow, identify problem spots, identify where traffic is flowing and how functions and business processes are being carried out in relation to each other.

Applications migrate off the mainframe and move first to the desktop linked by LANS. Movement is now toward the client/server architecture in which information is actually

brought in from the mainframe to a midrange and smaller computer and made accessible to users.

Finally, INPUT sees continued price performance for investment by companies in their information systems. Companies beginning to accrue benefits of having made these somewhat risky decisions, have provided models for other companies to begin participating in restructuring and re-engineering.

2. Facets of Re-Engineering

Through business re-engineering, organizations do more than improve a function or a technology. They fundamentally rethink the way they do business. Simply put, re-engineering involves:

- Viewing processes laterally, control across routine business organizations and departments
- Team assignments to perform complete operations typically called "focused cells"
- Worker empowerment by moving decisions to the lowest possible level
- Continuous improvement in terms of shortening all cycles in the business operations, working toward achieving 100% acceptable quality in all processes and products and 100% customer satisfaction
- Responsiveness to total market and individual customer needs
- Streamlining to perform only in a company's area of expertise, focusing on core competencies and mission-critical functions.

Exhibit III-1 and III-2 provide visual models of an old hierarchical structure, in this case, a discrete manufacturing organization and a re-engineered structure.

EXHIBIT III-1

Old Hierarchical Structure

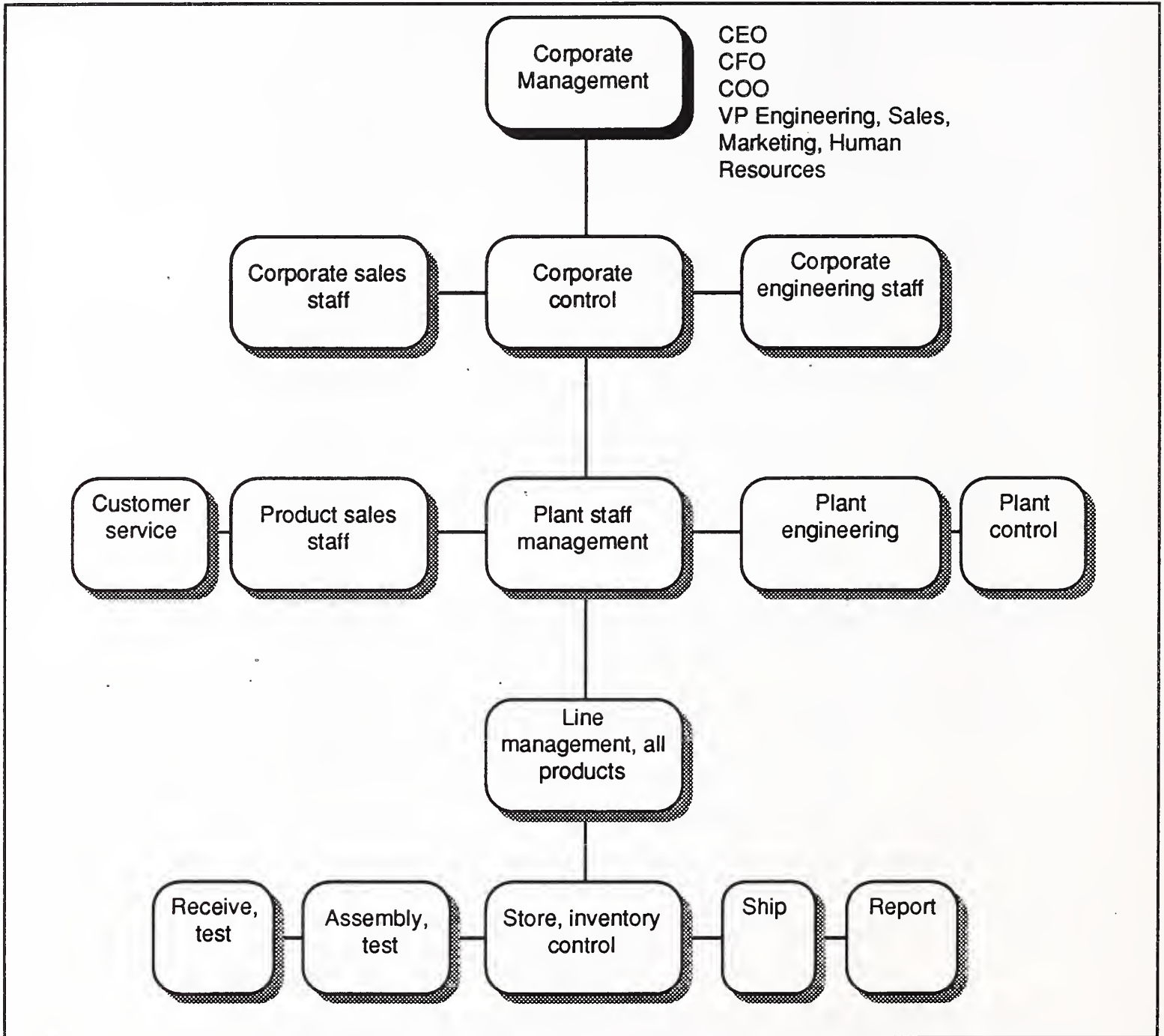
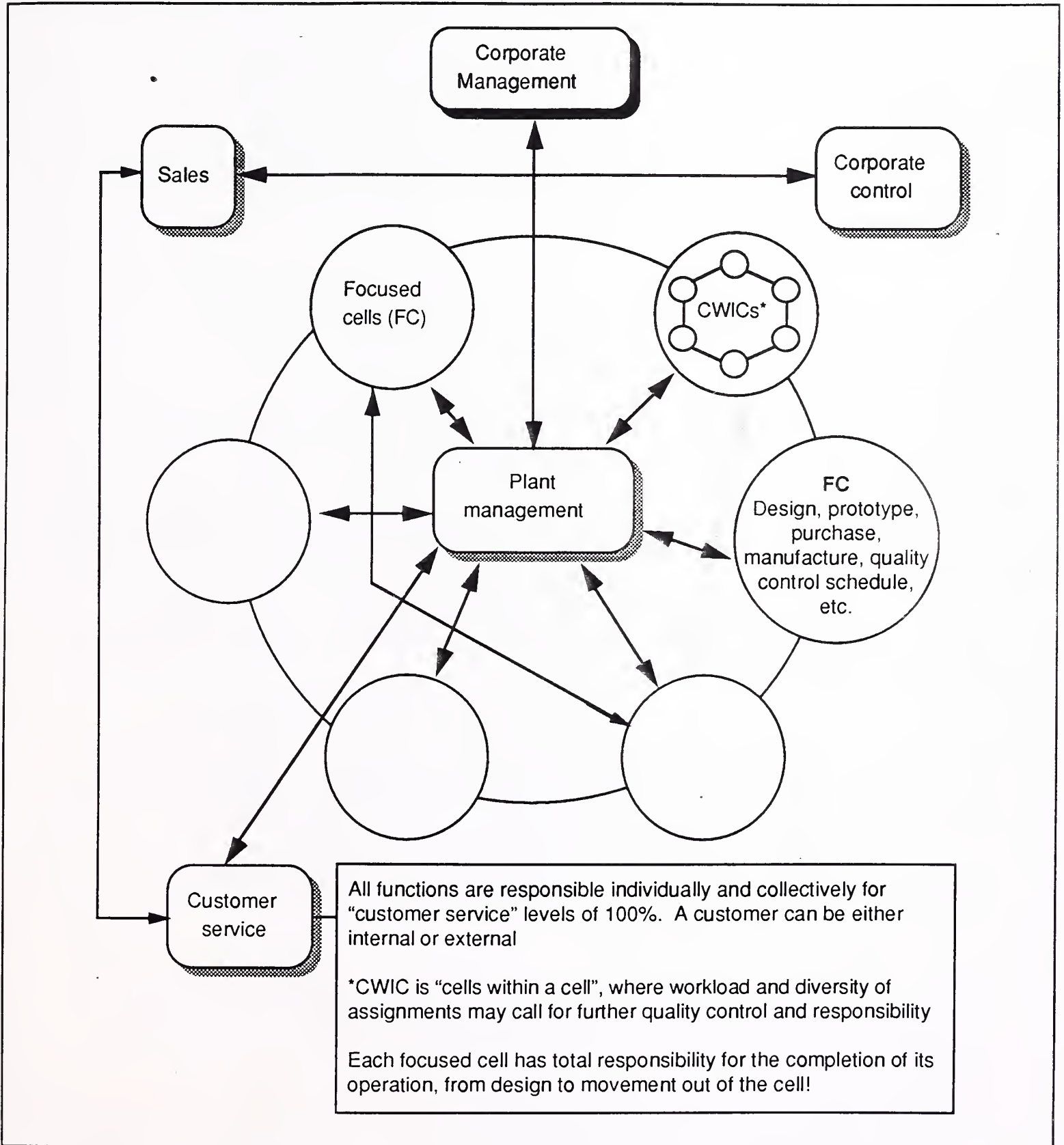


EXHIBIT III-2

Re-engineered Structure



The cellular structure is intended to lead to worker empowerment and accountability. Quality and service are the key watch words and the ability to react, in this structure, resides at the point of opportunity or problem. As worker involvement and the team approach succeed, real benefits to companies are becoming evident in terms of continuous improvement. For example:

- Product life cycles are dramatically shortening and time to market for new products is keeping pace with the change in customer demands.
- "Order receipt to shipping" cycles have contracted.
- Quality measurement reports describe staggering improvement.
- Cycle time reductions and improved quality are leading to greater customer satisfaction.

These improvements are leading automatically toward satisfying total market and individual customer needs.

Automation is aiding in this pursuit due to the electronic interchange of data and through advanced network services, i.e., electronic commerce.

As the restructuring has begun, a new phenomenon has occurred. Businesses have been able to streamline or downsize with a positive effect on overall performance. Operations that do not fit a company's normal practice are often outsourced. Product lines are being sold to implement redefined corporate strategies. Rather than having internal personnel added, professional services are being contracted out and middle-management jobs are being eliminated.

These changes are described in INPUT's Market Analysis Program reports on the process and discrete manufacturing sectors.

B

Electronic Commerce: Definitions and Impacts

Having this background on the climate and environment in which EDI has interacted with manufacturing, we now take a closer look at how EDI has traditionally been distributed, what its basic features and functions are, how it is growing, how it relates to the overall EDI concept and what is really happening in manufacturing trading communities. Who are the major players and how do they function?

1. EDI Distribution

EDI has traditionally been distributed in two ways. First, the EDI vendor approaches some member of the trading community that is providing supplies or services or some manufacturing function to the hub industry. The EDI vendor sells the idea and the software products or services to the supplier company we call the "spoke company." The spoke company then seeks EDI acceptance by the "hub company," the one that does the core industry business. In order to participate fully in EDI, the hub company has to interact with all of its spoke companies or all of those companies that are its suppliers—using EDI products. In this process the EDI vendor does not help the spoke company seek the acceptance of the hub company in implementing EDI. It is simply their job to provide EDI.

An alternative, yet still traditional way of distribution, is for the EDI vendor to approach the hub organization and seek its acceptance of the EDI concept and sell EDI services or products. At this point the hub becomes responsible for enlisting the acceptance and implementation of EDI by the spoke companies or their suppliers.

The spoke companies may also be customers. The most successful companies today who are trading EDI products have come away from the "spoke to hub" approach and have adopted the "hub to spoke" approach, which considerably increases their economies of scale. To do this, they have had to implement major educational efforts in supporting the hub companies in their programs to educate trading partners about EDI in providing licensing and consulting services for implementation.

These two methods are traditional approaches for distribution of EDI to manufacturing companies and a third approach will be described shortly.

2. Electronic Commerce Submarkets

EDI services and software are being used in this report as an indicator of the umbrella term, "Electronic Commerce" services. It is not the only product included in this definition. As already mentioned, the entire collection of products falls under the definition of Network Application Services, one of the seven product/service markets of INPUT's Information Services measures. Those services included in EDI are:

- EDI Services and Software
- Communication Network Services
 - Electronic mail, including integrated multimedia
 - Electronic information services, including databases and the information contained within them
 - Electronic catalogs. Those electronic compendiums of information available for making purchases by companies.
 - Point-of-sale services characterized by mechanisms using cards
 - Financial EDI and EFT
 - Workflow software systems

C

Effects on Major Markets

As just described, the trend in manufacturing companies is toward implementing these concepts of systems re-engineering, downsizing and total quality management. Wherever implemented, even though some re-engineered environments have only begun and benefits have not been totally accrued, results are being achieved at the aggregate level.

1. Examples

The following markets or (submarkets of manufacturing) have begun to show some changes:

- The semiconductor industry, after losing major market share, began restructuring in the mid-1980s. It has now regained the number one worldwide market position from the Japanese and has become the fastest growing industry segment in the U.S.
- The domestic automotive industry, by far the largest U.S. industry (after eight years of declining market share) is showing a resurgence and is theoretically operating in mostly mature markets with the market reaching \$14.3 billion in 1993.
- The computer and computer peripheral companies are maintaining strong, competitive postures and 8.2% growth for 1993 was higher than earlier expectations and especially positive considering the eroding positions of the traditional leaders.
- Heavy capital equipment, after a decade of market share loss, will regain profitability in 1993. This is a domestic industry which was considered dead prior to the recession.
- Instrumentation companies, especially in the medical fields, appear to be making inroads against previously stronger foreign competition and will continue its strong growth pattern.

2. Role of EDI

What exactly *is* the role of EDI in all of this? EDI has a tradition in many of the subsectors of manufacturing. Automotive, for example, was one of the launching pads for EDI. EDI has its roots deep in manufacturing and transportation. It has a 20-year history in a large number of committed, well-established, industrial users. Suddenly, EDI is finding itself in the middle of something called EC which is riding on top of a new wave of business process automation and technical functionality.

3. What is EDI?

First of all, EDI services and software contain: 1) Software which creates EDI messages, and 2) translates these messages into standard formats.

Secondly, EDI contains communication network services provided by either the EDI network service provider or by the company and its trading partners itself—either purchasing these services from a carrier or by going to a value-added network provider.

Finally, EDI requires complex application integration or makes EDI messages usable to the business process at the receiving end of the EDI message.

This third part of the requirement of basic EDI functionality application integration is often not available in EDI software or EDI services. It is not necessarily the responsibility of the manufacturing firm or the company at the receiving end to have the knowledge to integrate these applications or perform the integration.

However, many vendors have not taken the time to implement application integration functionality in their software. This may be one key factor in the somewhat stifled growth of EDI in the marketplace. On the other hand, it is a wonderful opportunity for vendor differentiation, on which some providers have capitalized.

As manufacturing organizations and their trading partners begin to evolve along this pathway of increased efficiency through systems re-engineering, implementation of client/server architectures, etc., EDI will have to play a role in facilitating information flow and provide the functionality that is required on top of these new architected structures.

The next section will take a futuristic look at EDI and what may be happening to software and services development as these business structures become more open. There will be a proliferation of UNIX and other open systems in operating networks and an overall theory of planning inside these organizations.



Futuristic Look at EDI in Manufacturing

A

Existing and Emerging Electronic Commerce Systems

The EDI marketplace will begin to take on dramatic changes as a result of the ongoing market restructuring in the U.S. In order to accommodate the needs of manufacturers, EDI software and services providers not only have to find solutions to the traditional problems of selling EDI (for example, developing adequate applications integration functionality) but they will also find themselves competing with open network systems software manufacturers providing EDI functionality internally. (Please refer to INPUT's report, *Open Systems and EDI*, 1993).

B

EC and Open Systems

1. UNIX and Network Operating Systems

Increasingly, INPUT is hearing about UNIX client /server architectures and Open Network Operating systems. In a recent study of EDI users, 33% said they had adopted UNIX specifically for EDI purposes, a third said they had adopted UNIX primarily to build or enhance their EDI capabilities and the balance responded that adopting UNIX was part of an overall corporate strategy for information services architectures.

The point is that users perceive the natural affinity between UNIX and EDI and the benefits to UNIX that are unique to inter-company data exchange. EDI is a type of client/server architecture with one company's order entry system the server to

another company's buying system, or one company's accounts payable system the server to another company's accounts receivable system.

2. Client/Server Architectures and Open Systems

Because it is a client/server architecture to begin with, the implementation and operation of EDI and EDI systems are naturally enhanced by open UNIX architectures. The open systems paradigm offers several benefits that are useful to the company trying to design an information system. For example, hardware independence and savings in daily operating expenses. Open systems provide particular benefits to computing applications that involve data exchanges external to the company—those situations where EDI is used, but not limited to EDI.

Open systems approaches, i.e., UNIX and others, allow for rapid response in customer communications as well as various ways to exchange data and integrate systems across the organization. It is very common when looking at software products or services that deal with this sort of environment to hear the claim "we connect anything to anything" or the ubiquitous availability of services, due to the fact that products communicate using a variety of protocols, standards or languages.

In addition to these points, open systems are flexible to changing market conditions. They are scaleable, and allow for changes in processing power corresponding to changes in levels of trade. New communications features can be added and operated parallel to existing proprietary systems if desired.

3. Benefits to Corporations

Exhibit IV-1 lists intercompany benefits of open systems.

EXHIBIT IV-1**Intercompany Benefits of Open Systems**

- Time-responsive to trading partner
- Excellent internal-to-external IS integration
- Scalable MIPs power supports EDI volume expansion
- Broad trading-partner communication alternatives
- Equitable distribution of systems costs among trading partners

Exhibit IV-2 lists benefits for systems development and Exhibit IV-3 lists the benefits to systems operations.

EXHIBIT IV-2**Systems Development Benefits of Open Systems**

- Inexpensive MIPS
- Interchangeable parts
- Easy to customize (once UNIX is learned)
- No need for expensive proprietary system experts
- No change in software when upgrading equipment

EXHIBIT IV-3**Systems Operations Benefits of Open Systems**

- More event-driven and responsive
- Better use of IS assets
- Less need for manual system-operator tasks

Those converting from proprietary to open systems can be divided into two groups: users who convert as part of a company-wide revamping of information systems like EDI, and companies converting only EDI functions. Companies that convert or are in the process of converting their entire company's information systems claim to spend up to millions of dollars in the process.

Companies who convert just their EDI EC capacity spend from \$15,000 to \$250,000 including equipment—EDI server software, communications software and other peripheral equipment such as modems or increased disk memory devices.

Despite the costs, several desired features of an open system are implied by the decisions companies are making, especially for the future. Exhibit IV-4 lists some of these features.

EXHIBIT IV-4**Features of an Open System**

- Full OSI compliance
- X.500 directory
- Easy to use network administration tools
- Real time capabilities
- Improved data mapping
- Internal document tracking and auditing
- E-mail, work flow features
- Direct connect to trading partners

The IBM AS400, a proprietary system, has sold well in general and specifically as an EDI platform. EDI translation software sales for the AS400 as a single category of EDI software, has maintained the highest growth rates in sales for the past two years. Growth is expected to continue as companies migrate the AS400 to a strong target platform.

There are several EDI vendors selling in this category: Systems Software Associates, Extole, Premenos, Sterling Software and Blue Rainbow. Some users commented that the AS400 is more sophisticated in features than UNIX.

Also, Microsoft NT will soon become another contender as an alternative to UNIX in driving EDI systems.

In manufacturing these changes will have an impact on automatic process controls, automated conveyor systems and the uses of EDI throughout business processes and planning systems. In the past, many homegrown applications were used where ready-to-use packages were not available. The situation has now changed. Process manufacturers can now take advantage of their past automation combined with these new application packages to implement client/server environments.

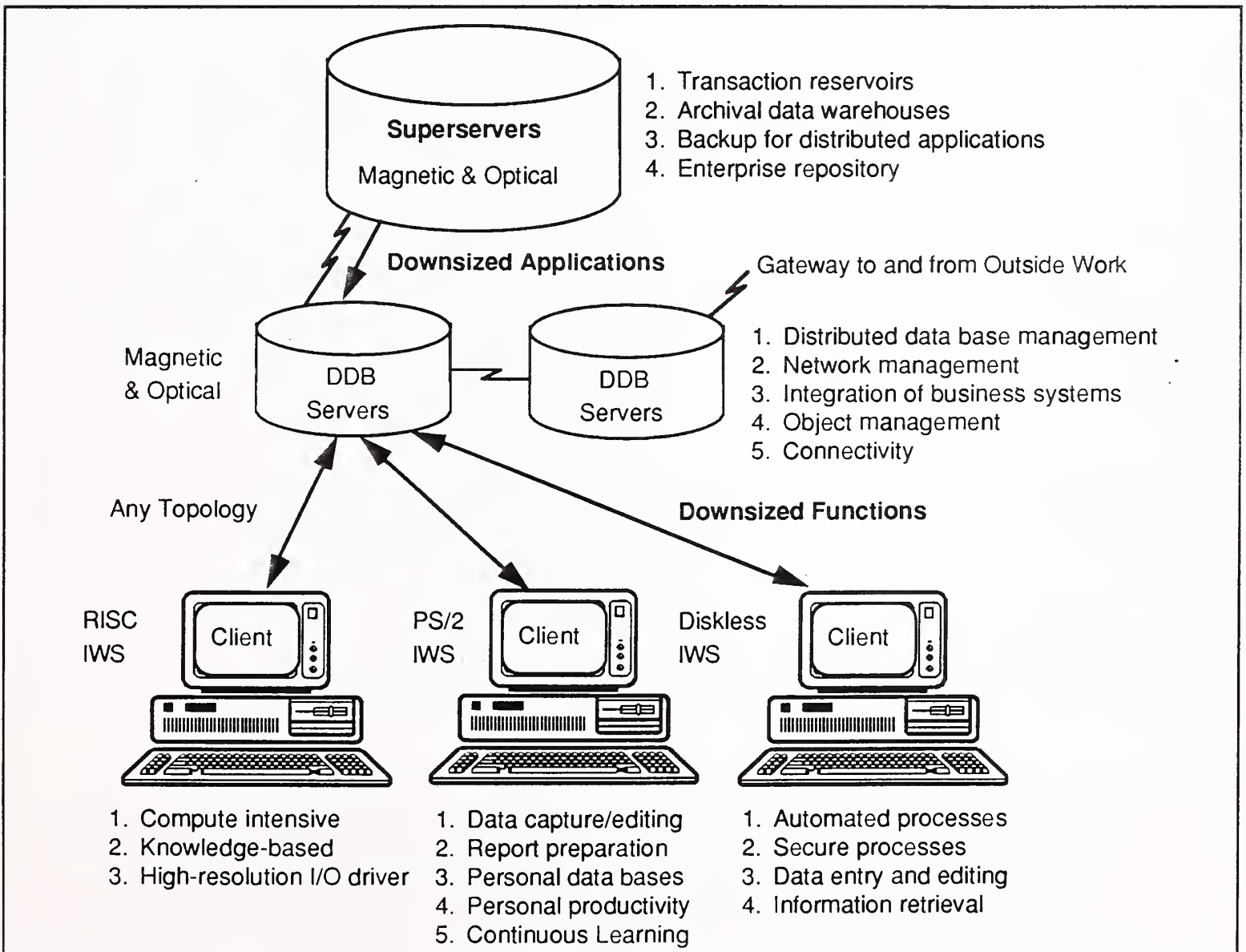
4. Old and New Designs for Manufacturing

Exhibit IV-5 details a three-tiered downsized application and functions model based on the client/server architecture highly applicable to the manufacturing sector.

Finally, most organizational plans for future changes involve installing new applications at the workstation- or PC-level with mainframe applications being the next often-stated planned change and minicomputers being the least.

EXHIBIT IV-5

Three-tiered Downsized Applications and Functions Model



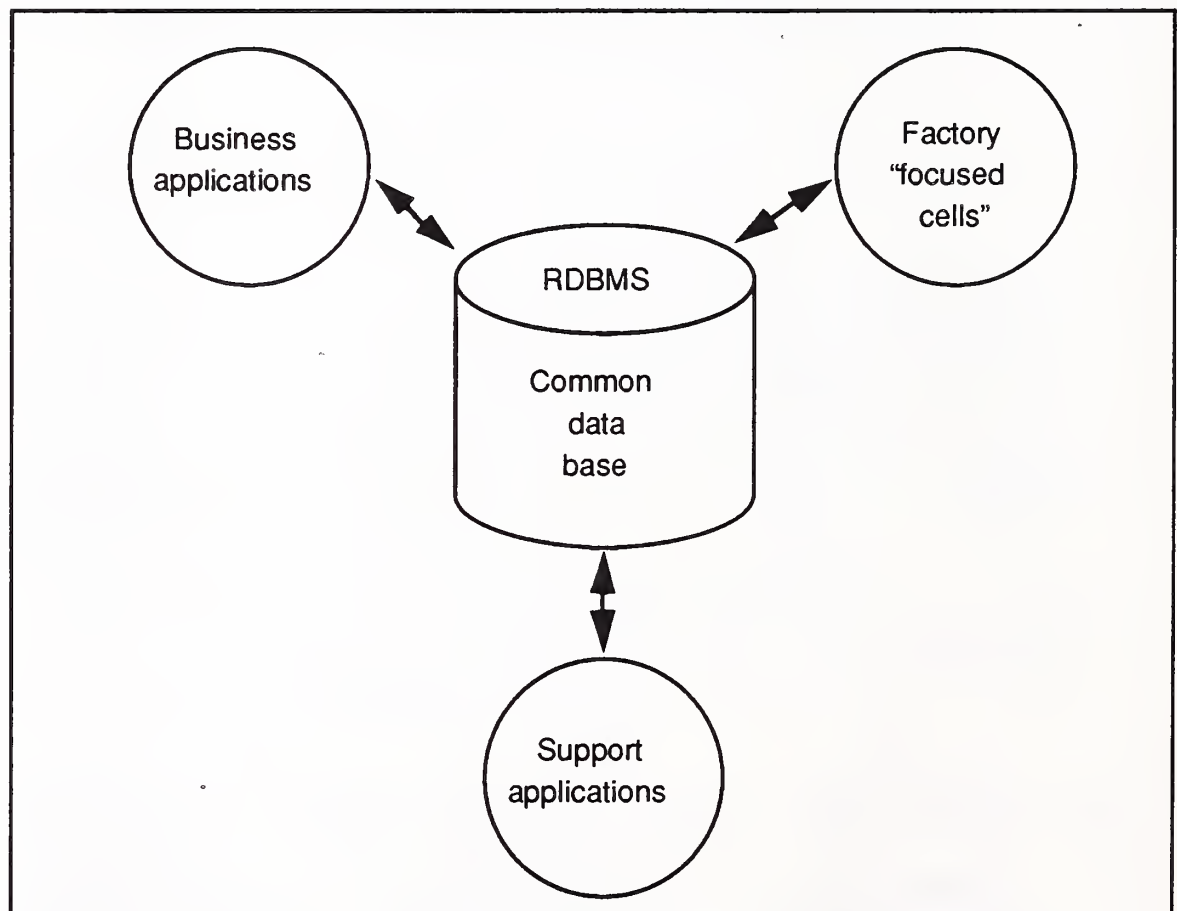
The old systems architecture in manufacturing (before re-engineering) had several problems. First, each database that was

used was its own island, in effect, not necessarily accessible from other departments. A significant amount of hardware and software integration was required and, at that point, the cost of computing was high and LANs were not as ubiquitous as they are today. Moving information was fairly costly.

Exhibit IV-5 gives the old manufacturing structure in process manufacturing and Exhibit IV-6 shows how the structure has changed after re-engineering.

EXHIBIT IV-6

CIM in the Re-engineered Business



The simplified model illustrates how critical interconnectivity and interoperability are to the concept of open systems. UNIX-based application packages have increased user involvement and a move to client/server environments is the beginning sign of true open systems.

EDI, growing out of the automotive industry, has become a necessary component of manufacturing systems environments. This is especially true in process manufacturing where orders

and shipments can contain many items, many delivery dates and many delivery points.

EDI capabilities are moving far beyond the initial stage of simple order transmission. Information systems departments are now working on complete information exchange including orders, acknowledgments, shipping acknowledgments, invoicing and even production schedules. Although most companies have some EDI in place, INPUT expects the steady pace of new developments to continue.

5. Business Processes Affected

Business processes facilitated by EDI applications in the manufacturing sector include strategic and planning processes, lead tracking, enterprise resource planning, forecasting, material requirements, capacity requirements, labor machine requirements and production.

Tactical and execution processes include sales, order entry configuration, scheduling, rescheduling, process and product quality assurance, purchasing, receiving and inspection, labor machine tracking, maintenance, emergency prevention, shipping, inventory control, logistics and distribution, customer follow-up, reporting and communications.

In the control and accounting area business processes include: accounts payable, accounts receivable, payroll, general ledger, regulatory compliance and costing.

In the support area: customer service, serial and lot control by sight, call handling, follow-up, engineering, flow design, process quality, manufacturing over sight, quality assurance and human resources.

Manufacturing and resource planning packages exist (MRP, ERP, PDS) which relate to the implementation of client/server architecture and the reautomation of these sorts of business processes. A surprising number of companies in INPUT's research anticipate using MRP packages. Mainframe-based vendor software maintenance charges, for instance, can be as high as \$100,000 annually, but newer MRP systems are much less expensive. Maintenance is charged as a percent of sales price, so less expensive systems have lower recurring charges.

The typical client/server MRP system is sold by seat (number of concurrent users). It can be relatively inexpensive to start up a new system and then add seats as the implementation matures.

In manufacturing, implementation of these sorts of systems can help with intermediate steps in production and also deal with byproducts and coproducts. In terms of intermediate steps in production, sometimes the raw material will be used in more than one product or subsequent step.

This is particular to process manufacturing. Sometimes a complete stoppage is required while an intermediate product cures. The product may change unit of measure at the end of a particular step. In terms of byproducts and coproducts, many process companies create more than one end product at a time. At one step, a product which is considered an end product may appear, while additional processes may turn it into another product. These are particularly difficult problems in setting up a manufacturing process to run a business, and are an extreme case of the obvious need for EDI software developers to take into consideration the specialized needs of the expected users of their software at the business process end. This reinforces the idea that vendors need to take further responsibility for application integration.

C

Effects on EDI Distribution

1. EDI Functionality

Keeping in mind the changes that have been described in manufacturing industries and the role that EDI will be expected to play (and is playing) in re-engineering processes, and also the increasing openness of network operating systems and architectures being considered, INPUT suggests that systems software developers will begin offering EDI functionality—for example, Microsoft using TSI's Mercator and Novell, with Premenos' EDI/E in UNIX.

This suggestion has been previously made in INPUT reports on EDI and Open Systems Architecture. The trend is consistent with the trend toward network operating systems and could result in

EDI software being sold directly by network operating system vendors.

2. Future Distribution

If this occurs, future distribution of EDI may be:

- From software vendors (TSI, ATI; Delrina Forms, General Magic Telescript; Novell's Univell, Microsoft NT) to resellers at large and small companies.

Examples of large firms would be Wal-Mart, JC Penney, Levi Strauss, Alan Bradley and LSI Logic.

- Distribution may also go from systems integrators (EDS, TI, Informix, Access Systems Software) to large companies and small companies. Future distribution will continue to involve industry specific service providers to large and small companies and from software vendors to large companies which then distribute to small companies via their traditional hub and spoke routes.
- Finally, distribution of EDI may take the form of mass market PC applications and users who own their own systems, to small companies for horizontal application solutions.

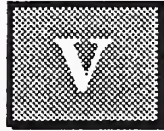
D

Future Organization of the Software Market

As a result of these changes what we may see are software vendors providing systems in which to nest EDI/EC products. We would see:

- Mass market PC vendors—Microsoft, Novell, Intel, Delrina, Lotus
- Non-PC—Tandem, IBM, AS400
- Technology vendors—EDI, Work Flow
- Systems software vendors—Microsoft, Novell, IBM

We could also see the traditional EDI software vendors—usually smaller companies providing specific functions—for example, encryption, work flow, bar code scanning, file format translation. After this, only technology software selling to mass markets and non-PC users would remain. In other words, the market could experience the disappearance of some EDI software vendors, as we know them today, if they end up competing with network operating systems, and if these systems have an advantage in capturing the marketplace for systems riding on top of newly architected corporate communications infrastructures.



Market Analysis: EC in Manufacturing Industry Sector

A

Existing and Emerging Electronic Commerce Systems

In summary, forces in the marketplace are leading to increased use and some changes in EDI and other EC products. These forces include economic changes, the introduction of client/server systems/open systems network operating systems, and changes focused on reducing costs/downsizing organizations for the purpose of realizing increased return on investment and profitability.

1. Inhibitors

Some inhibitors to these changes include the requirement for customization of products in manufacturing to achieve integration, training required and long implementation cycles, and the existence of replacement systems in restructuring.

2. Network Services Market for Manufacturing

Network Services is the smallest sub-sector in the overall manufacturing Information Services market. However, it is one of the fastest growing areas (see Exhibit V-1). It is expected to grow 18.5% annually between 1993 and 1998. The Network Services marketplace is estimated to be more than \$1 billion growing to \$2.6 billion by 1998.

EXHIBIT V-1

Growth in Manufacturing Network Services

	1993 (\$ Millions)	1998 (\$ Millions)	1993-1998 CAGR (%)
Discrete Manufacturing			
Network Services	128	334	21
Electronic Information	62	148	19
Network Applications	66	186	23
Process Manufacturing			
Network Services	1,079	2,265	16
Electronic Information	915	1,725	14
Network Applications	164	540	27
Combined Manufacturing			
Network Services	1,207	2,599	18.5
Electronic Information	977	1,873	16.5
Network Applications	230	726	25

Source: Information Services Market Analysis Program; INPUT

The overall market is expected to grow 21% through 1998, from \$130 million in 1993 to \$330 million in 1998. The largest contribution in this area will come from the expansion of EDI services and applications.

3. Electronic Commerce Market

The EC marketplace is expected to grow from \$4.1 million in 1993 to \$8.3 million in 1998. The overall growth rate is 15%. (Source: *Input Electronic Commerce Annual Report*).

Exhibit V-2 displays growth rates for the EC marketplace by software products, network application services, electronic information services, professional services and equipment.

EXHIBIT V-2

Comprehensive Information Technology Market for Electronic Commerce

	1993 (\$ Millions)	1998 (\$ Millions)	1993-1998 CAGR (%)
Software Products	362	1,010	23
Network Application Services	926	2,920	26
Electronic Information Services	2,297	3,300	8
Professional Services	50	140	23
Equipment	500	900	12
Total	4,135	8,270	15

Source: EMF

Exhibit V-3 gives us the EC software market including EDI, electronic funds transfer, E-mail and other EC products. The software market is expected to grow from \$360 million in 1993 to \$1 billion in 1998, at 23% AGR.

EXHIBIT V-3

Electronic Commerce Software Markets

Discrete Manufacturing	1993 (\$ Millions)	1998 (\$ Millions)	1993-1998 CAGR (%)
EDI	149	400	22
EFT	28	60	16
E-mail	33	500	26
Other	25	50	15
Total	62	1,010	23

Source: EMF

Exhibit V-4 shows leading PC midrange and UNIX-based EDI software vendors. All of these vendors provide software for the manufacturing industry.

EXHIBIT V-4

Leading PC, Midrange and UNIX-based EDI Software Vendors

	1993 (Rev. \$M)	One Year Growth (%)
PC		
Supply Tech	11	22
TSI	7	40
EDI, Inc.	5	0
ABC	4	14
APL	4	25
EDS	4	33
Others	34	-
Total	69	
Midrange		
Premenos	13	-
Sterling	5	-
Others	4	-
Total	22	
UNIX-based		
ABC	4	-
Premenos	2.5	-
T.I.	2	-
EDS	2	-
Others	6.6	-
Total	17	

Exhibit V-5 shows the Electronic Commerce Network Services marketplace. This includes EDI, E-mail, fax, EDI/EFT and electronic information services. Network application services excluding electronic information services totaled \$926 million in 1993 growing to \$2.9 billion in 1998 for a CAGR of 26%. EDI will amount to about \$250 million in 1993, growing to \$500 million in 1998 for 15% growth.

EXHIBIT V-5

Electronic Commerce Network Services Markets

	1993 (\$ Millions)	1998 (\$ Millions)	1993-1998 CAGR (%)
Network Application Services			
EDI	252	500	15
E-mail	520	1,440	23
E-fax	20	900	50
EDI/EFT	7	40	19
Misc	7	40	19
Subtotal	926	2,920	26
Electronic Information Services			
Credit	1,475	1,600	2
Product Pricing	175	400	18
Subtotal	2,297	3,300	8
Total	3,223	6,220	14

Source: EMF

Exhibit V-6 shows the EDI network services market selected vendors. All of these vendors provide services in the manufacturing area.

EXHIBIT V-6

EDI Network Services Vendors (Selected)

Vendor	1993 Revenues (\$ Millions)	Growth Over 1992 (%)
GEIS	72	38
Sterling Software	39	22
Advantis	37	16
RAILINC	15	15
kleinschmidt	13	8
Harbinger	11	10
Transnet	11	10
MCI/BTNA	9	13
Others	45	
Total	252	

Others: ATT, EDS, Stentor, TransSettlements, EDI Able, Ameritech, Maersk, US Sprint, ARINET, Immedia, NDC, DunsNet, "Others"

B**Penetration of and Expenditures on Electronic Commerce in Manufacturing**

EDI penetration in the manufacturing sector was recently measured in the EC annual market analysis. Penetration was defined—"one out of three applications being implemented today involves EDI." In the survey of approximately 1,600 information services managers, 33% reported developing corporate information systems that have EDI components. In process manufacturing, 386 applications were described with 131 or 34% being EDI applications. In discrete manufacturing, 435 applications were described, and 23% or 101 were EDI applications.

Current EDI users plan to spend as much and probably more this year (than they did last year) on EDI. Of the sample of 134 EDI users, more than 70% reported that they will spend the same as last year or more, for EDI software, services and related systems development. Slightly more than half reported they will spend more this year than last year.

More than half of the expenditures for an EDI program are spent on external products and services. The average expenditures for various EDI components breaks down as shown in Exhibit V-7.

EXHIBIT V-7

Average Spending

	Annual Spending (\$1,000)
EDI Software	13
EDI Network Services	36
Internal Development	48
Outside Consultants	26
Total	123

Slightly more than a quarter of EDI systems being implemented are part of an effort to downsize IS resources.

In addition, 41% of EDI applications being implemented are in client/server mode. Process manufacturing and discrete

manufacturing are among the two industries with the highest amount of downsizing activity.

This represents a sizable amount of activity in network architecture, re-engineering and organizational downsizing. To be more specific, in terms of platform utilization, Exhibit V-8 shows discrete manufacturing and process manufacturing respondents in terms of the number of mainframe, minicomputer and client/server platforms being utilized with their applications. In discrete manufacturing, standalone minicomputers are used slightly more often than client/servers. In process manufacturing, client/servers are used twice as often as the minicomputers. Here we see a real difference, other than definitional, in the two manufacturing areas.

EXHIBIT V-8

User Survey Response to EDI Platforms

	No. EDI Applications	On Mainframe Platforms	Percent	On Mini-computer Platforms	Percent	On Client/Servers Platforms	Percent
Discrete Mfg.	101	30	30	46	46	43	43
Process Mfg.	732	39	30	27	20	58	44

Source: INPUT report *The U.S. EDI and Electronic Commerce Markets, 1993-1998*

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Vendor Profiles

The purpose of this chapter is to describe those EDI vendors providing services or software to the Manufacturing sector. Of 40 EDI vendors profiled by INPUT, 25 offered services or software to Manufacturing.

Listing alphabetically: Advantis, Ameritech, The APL Group, ARI Network Services, ATT EasyLink, DEC, EDI Able, EDI Inc., EDI Solutions, GE-IS, Genzlinger Assoc., Harbinger, Kleinschmidt, LDJ, Lloyd Bush, Transnet, NDC, Perwill EDI, Piedmont, RMS, Railinc, Spint It'l., Sterling, Supply Tech, System Software.

In the case of the largest EDI vendors (as measured by revenues), services are provided to most industry sectors, manufacturing included. Those include GEIS, Sterling Software, Advantis. Others including ATT EasyLink, Harbinger, Kleinschmidt, Transnet, NDC and Railinc, also provide EDI services to Manufacturing.

Software, only providers include Supply Tech, DEC, APL, ARI, EDI Able, EDI Inc., EDI Solutions, Genzlinger, LDJ, Lloyd Busch, Perwill, Piedmont, and RMS.

Selected EDI Services and Software providers will be profiled for the purposes of this report.

They were selected on the basis of their strength as a service and/or software provider. They may provide a full range of services or software, but our analysis for the purposes of this report will attempt to focus on their strongest area.

Contact INPUT for more information on pricing and technical detail.

A**GEIS (Services)**

401 North Washington St.

Rockville, MD 20850-1785

Telephone: 800 EDI-KNOW (U.S. and Canada)

Telephone: 301/3404750 (outside U.S. and Canada)

GEIS's EDI business represents only 10% of GEIS's total revenues and total GEIS revenues represent about 1% of GE revenues. Despite its diminutive stature among corporate GE, GEIS is now one of GE's 13 principal divisions. It is interesting to note that this "relative revenues" problem also exists among ATT EasyLink, Sprint Int., MCI's EDInet and Advantis. In these telecom examples, however, the EDI unit does not enjoy the same organizational security. INPUT believes this becomes significant in very large companies attempting to provide quality EDI.

Products contributing to GEIS's revenue base include: Application/Data bases (COEP, UPC*Express, CARGO*Link, Design*Express, EPS*Express); Generic Software Products (EDI*PC, EDI*Benchmark, EDI*Central, EDI*UNIX, EDI*PC Advanced System and EDI*PC Lite) and Network Services (EDI*Express, Petrodex).

Functionally, these products provide transaction and utility processing; inquiry/response, electronic data interchange, and value-added network services; systems integration; and software development and network management professional services to over 13,000 corporate and association clients worldwide.

Thirty-two percent of GEIS's \$55M revenues is derived from Manufacturing. The rest are from Banking, Telecommunications, Trade and Transportation, Retail and others.

Sixty percent of GEIS' business is derived from the U.S. and the remainder from non-U.S. companies.

GE refers its EDI business across its 12 other divisions to GEIS and so GEIS is experienced in a broad range of manufacturing areas. Transnet is one specific EDI service offered by the Motor Equipment Manufacturers Association where GEIS has an OEM type arrangement.

INPUT believes GEIS offers a comprehensive Electronic Commerce program with a strong global networking and processing service as its backbone. GEIS has competed in the VAN market for years and has continued to increase its marketshare by offering good services and emphasizing business application solutions where appropriate. This was key to its successfully maintaining profitability during the recent recession when its sister companies did not.

On GEIS's network resides its EDI product as an enabler and then business communications products (E-mail, Fax, EDI, data bases, point of sales services) to fully integrate its Electronic Commerce products.

EDI*EXPRESS provides the full range of EDI services and functionality. It supports all major standards and connects to any public EDI VAN. Both low and high speed connections are available and services extend to over 35 countries. Both translation and mapping are included in software products, graphical user interfaces and integrated E-mail are available. These are top of the line EDI features available on a public network.

B

Sterling Software (Services and Software)

Electronic Commerce Group

PO Box 7160

4600 Lakehurst Court

Dublin, OH 43017-0760

Sterling Software, with headquarters in Dallas, TX, is a worldwide supplier of software products and services in markets reflected in group names: Enterprise Software, Electronic Commerce, Federal Systems and International. The Electronic

Commerce Group consists of four divisions: The Interchange Software Division, The Network Services Division, The Communications Software Division and The Banking Systems Division. Customer solutions are coordinated amongst divisions routinely.

INPUT considers Sterling's Electronic Commerce Group to be one of the leading EDI Software and Services vendors in the world. It has offered networking since 1975 and pursued a growth path including acquisitions, alliances and partnerships. Most recently it acquired Systems Center which added an a global sales and services network, a major addition for Sterling's offering.

Sterling dominates the hardware retail/supplier industry, grocery, pharmaceutical and distribution sectors. It has expanded its share of the broader retail industry, transportation and manufacturing sector. International expansion is underway, especially in Canada, the U.K. and Japan.

Services are organized into groups. Communication services include EDI, E-mail, File Transfer, enhanced fax. Enabling services include EDI management, E-mail workstations, X.400 software, security software and monitoring software. Value-added shared applications include EDI-enabled applications for trading partner communities, database services, shipment tracking, RFP/bid award bulletin boards and others. Client services include EDI education, mapping services, implementation services but not systems integration or programming services.

Sterling's COMMERCE:Network provides EDI, E-mail, Library services and File transfer services. All major protocols are supported and internetworking with all major networks is available. COMMERCE:Marketquest is a database service which builds on EDI documents specific to groups of trading partners.

Sterling's broad range of quality software is well known. The GENTRAN family of products handles EDI translation and control for mainframe, midrange and PC platforms and supports all major OS environments. All standards are supported. Other management, software maintenance and security features are available. GENTRAN Plus for mainframes builds on GENTRAN and SUPERTRACS (Sterling's communication engine) to integrate translation, communications, mailboxing and mapping

into a fully automated EDI operation. The VECTOR line of products offer check and electronic payments processing for financial institutions.

C

Advantis (Services)

Messaging Solutions Center

4307 W. Dr. Martin Luther King Jr. Blvd.

PO Box 30021

Tampa, FL 33630

Advantis, the merger of two experienced EDI network providers and two global networks, came to the EDI market in 1992. IBM holds 70% stake and Sears, the remaining. Services offered include Advantis Custom Network Solutions; Advantis Network Services; Advantis Messaging Services, Advantis Capacity Services and Advantis Information Services. EDI services and software are offered as part of the value added network .

The Advantis network services 10K U.S. customers with international access to 92 countries through IBM affiliates. There are over 1 million user I.D.'s accessing 650 cities, using over 3500 interconnecting networks. The IBM portion of Advantis was formerly IBM's Information Network and competed in the VAN market against MCI, ATT, Sprint, GEIS, Infonet, Compuserve and others to offer a broad range of data communication services.

Electronic Marketplace* (Advantis' Electronic Commerce equivalent) includes E-mail, EDI, credit card transaction processing, bank-to-bank EFT (ACH), access to on-line databases and data communication services for its many subsidiary businesses (in retailing, insurance, real estate, and securities brokering) as well as commercially (in the EDI, healthcare and ACH/banking areas).

Advantis views EDI as a peculiar form of outsourcing and placed EDI at the disposal of IBM's outsourcing group. The synergies between these two is expected to stimulate EDI business. Advantis will also leverage its position in the retail industry and Sears'

position as the second largest retailer in the country. Advantis offers its services across industries including manufacturing. They also develop and implement custom network solutions.

INPUT believes Advantis, through its experience in the VAN market can become a very strong EDI provider to manufacturing. Currently, software products cover mainframe, midrange and PC platforms and graphical user interfaces for the midrange and PC versions. These cover both translation and management. Translation software can be used for either real-time or event-driven EDI; can provide support for just-in-time applications or can communicate via mailbox. All major standards are supported.

Advantis offers EDI enabling services at no extra cost for bring up trading partners and for implementation and application integration. Advantis takes a very hands on approach to facilitating the use of EDI in the trading partner environment. These functions are not built into the software and custom programming is conducted where needed.

D

Supply Tech (PC)

1000 Campus Dr.

Ann Arbor, MI 48104

Telephone: (313) 998-4000

Supply Tech is a leading vendor of PC EDI software with the largest installed base in this category. Its earliest product was an IBM PC-based EDI software for the automotive industry but it has continued to expand its market to cover various other industry sectors—including manufacturing—and throughout the world. Some of its customers include Caterpillar, Inc., ATT, IBM, G.M., Jordache, Ford Motor Company, Businessland, Hitachi, the U.S. Government and other Fortune 500 companies.

Supply Tech provides no other services or produces no other products other than EDI and bar coding software.

Supply Tech's general-purpose microcomputer EDI software is STX and supports transactions including releases, advance ship notices, purchase orders, PO acknowledgments, requests for quotes, quotes, invoices, remittance advice, Bills of Lading and CAD files. (Presumably, these are the business functions offered by other vendors with "full range" of EDI services. This list is included as a standard for comparing the actual business processes which are supported across EDI vendors.) STX supports all major standards including industry specific standards. The STX method of handling various standards simultaneously is patented.

STX for microcomputers runs on IBM and compatibles, connects to most public and private EDI networks, supports high and low speed access and communication, ready to use transaction formats and other features making it secure and user friendly.

STX for mainframe runs also on IBM, supports all major standards and is compatible with STX for microcomputers. STX has an installed base of 12K sites and continues to grow.

The patented STX approach to translation is referred to as Overlay. It allows any number of standards versions levels and trading partner variations to be handled concurrently. More than 4K Overlays corresponding to EDI hubs have been created for more than 1000 hubs supported.

An advanced mapping feature called XMAP has been added for application file integration. No programming knowledge is required to maintain the application interface using XMAP.

Services provided include installation, training, software maintenance, network connection services, hub/trading partner testing, hotline technical support and updates.

Supply Tech has a strong sales and marketing organization with a broad reach. It consistently receives high praise from customers after the sale. (A 24-hr help line contributes to this.) But Supply Tech has not expanded their product offerings and are not a network services provider. These points will limit their growth. They have, however, established a variety of EDI relationships which add some depth to their EDI portfolio: STX connects to all third-party EDI networks and most private ones; it acts as an agent for ATT, MCI (formerly BTNA), IBM, Sterling and GEIS

value added networks; co-markets products with ATT, MCI, Ameritech; and has products resold by a wide variety of firms in countries all over the world.

E**TSI (PC)**

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TSI International develops and markets software for IBM mainframes and PCs with special focus on solutions for delivery of data to production systems. TSI addresses the market needs of traditional data entry as well as EDI. It is an IBM Business Partner.

It was not until after their data input software business had matured that TSI entered the EDI market with a capital investment by an outside venture group. Trading Partner, the mainframe translation software product was rolled out in 1990. TSI also acquired TransSettlement's TransLate EDI software for IBM customer base and license and the PC-translator company Foretell Corporation. This beginning has given TSI's EDI products a firm start.

TSI sells to Fortune 2000 hubs and trading partners. They take the "hub to spoke" approach, with mainframe EDI software to the hub and PC EDI to the spoke. They have been very successful with this approach, selling EDI kits - preformatted PC software customized for large hub companies.

Seventy-five percent of revenues come from U.S. accounts and the remainder from non-U.S. sales, especially in the U.K. Sixty percent of TSI's revenues come from KEY/MASTER and 40% from EDI products. Most mainframe EDI installations are in the U.S. while PC software has been sold more widely in the U.K., Europe, Hong Kong, Singapore and Australia.

TSI's EDI product Trading Partner, is a high-performance, mainframe-based EDI translation and mapping product. It is also an exceptions manager, applications gateway, data integrator, administrator, auditor and scheduler. It supports North

American (x12 & variations), EDIFACT, TDI (Tradacoms, Brokernet) standards. It runs on IBM and IBM compatible mainframes with MVS, MVS/XA, MVS/ESA or VSE operating systems. Services offered include implementation assistance, consulting, product training, bulletin board services, 24-hour hot-line, standards updates, user conferences, user newsletter, complete partner rollout programs with Windows-based package for smaller partners.

Trading Partner Express operates in much the same way and offers many of the same functions but does so on a server-platform. In addition to the Trading Partner features, Trading Partner Express offers a monitoring and control module.

Trading Partner PC is a high performance translation product for Windows. Graphical user interfaces, translation, communication and integration of other applications (spreadsheets, word-processing, E-Mail, accounting software make this an extremely user friendly EDI system. The system is designed for easy roll out of EDI for trading partners. The Trading Partner PC kit includes customized implementation guide, data entry screens, turnaround documents, reports, and communications software.

Mercator, TSI's mapping program designed to run on the PC, is sold separately and provides the ability to transform data from one structure to another without writing code. This mapping function is performed with a high level of power and simplicity in a GUI environment. It is a Windows-based product which runs on IBM PC compatibles and supporting X12, EDIFACT, TDI and industry specific standards.

INPUT believes that TSI has entered the EDI market intelligently and with skill. A product is offered for any IBM and compatible platform, responding to customer current needs for PC and client server based systems accessible via graphical user interface. Presumably, network connectivity is not an issue since communication products are offered. This solution may not serve TSI well in the long run since their competitors have networks of their own, in many cases. On the other hand, this may be the perfect solution to the existence of multiple and disparate global networks.

F**ABC (UNIX-based)**

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American Business Computer (ABC) is a well known UNIX-based EDI software manufacturer. ABC's customer base has grown primarily out of the commercial and government areas, but the software has rapidly spread across all industry sectors. It has also significantly increased its relationships via alliances and strategic partnering for marketing its translation products.

ABC's basic product, EDI-Server provides traditional VAN capabilities such as store and forward transport, mail storage, high and low speed access and transmission, reporting and auditing...all in a server architecture. The redundancy of installing EDI translators on multiples host-based applications is removed thus reducing resources required to maintain the EDI program. the server approach reduces programming and staffing requirements. Customers are asking for this today, as mentioned earlier.

The EDI-Server Mailbox allows trading partners dial-in access, administers users and security information, monitors communication sessions, tracks data and provides audit information. It runs on IBM, NCR, ATT, HP, Sun and SCO platforms.

EDI-ExCel is designed for users with minimal technical expertise to get the system up and running. Easy mapping facilities are included. The software runs on 20 different platforms. It comes in pre-programmed packages for specific vertical market environments. for retail and auto sectors.

ABC implements Electronic Support Service for bulletin boards with on-line inquire to ABC Informant newsletter, on-line trouble log reporting, update distribution for latest software releases and EDI implementation consulting.

ABC has developed products which operate on the widest range of platforms possible. This is a strength when compared with those only running on IBM platforms. In addition, ABC has done a good job of partnering and this may be the factor which rounds out their EDI offering. This is an appropriate approach to providing a full portfolio in today's market and customers may even see this as a strength.

G

Premenos (Midrange)

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Premenos specializes in electronic commerce focusing on engineering and technical expertise on EDI and e-mail for IBM midrange computers and UNIX systems. It has positioned itself in an emerging marketplace. By traditional EDI standards is "narrowly" focused.

Its midrange EDI products are called EDI/400, EDI/38, EDI/36, EDI/e and QMAIL. EDI/e is Premenos' Unix based EDI product and QMAIL is Premenos' e-mail product..

Premenos provides products to more than 2K customers in all industries. It is considered a premier EDI software vendor in the midrange marketplace. It has brought strong research and development capability to the development of Q-Mail, EDI-e development language and UNIX translator products.

The midrange sector should continue expanding. It is the ideal platform for conducting "production level" EDI. Midrange platform is the natural migration destination for both the EDI user who started on the PC and needs to add capacity and the EDI user that started on the mainframe but wants to downsize and run divisional EDI. Midrange computers are heavily entrenched in transportation, manufacturing and distribution industries - which are the three mainstream EDI marketplaces.

All of Premenos' products manage communication, translate, schedule, and provide application interface . They can be configured to run unattended in batch mode for nighttime processing or to take advantage of reduced network charges. They provide speed, flexibility and security when handling large data volumes.

These products are compatible with IBM AS/400, S/38, S/36 and the RS/6000. Products are compatible with most public networks, including industry specific networks. Services include consulting, E-mail, hot-line, interactive standard maintenance, management reports, installation, standards updates, trading partners workshops, mapping, unattended systems operations, user documentation, and user conferences.

From the traditional EDI vendor perspective, Premeonos may appear to be narrowly focused. They have no network of their own, they have no obvious "hub to spoke" or "spoke to hub" implementation strategies. For many, mapping is being integrated into software rather than describing it as an extra service. Premeonos as left it in the service category.

What Premenos has done is intelligently selected the growing platform sector on the largest installed base (IBM) and developed an EDI product which will serve a undeniable set of customers. They have packaged their products to focus on this rather sophisticated potential user with interesting print materials to go along with it. They are positioned for a specific market and in the long run will have to expand their services should this population turn to another solution or should a formidable competitor appear. IBM already resells their product so IBM is not a threat.

Premenos' UNIX product may make up for the company's lack of PC or mainframe products.



Conclusions

A

Business Environment

While the U.S. manufacturing industry is recovering somewhat from the recession, economic changes and pressures will not stop as the world economy continues to grow. Worldwide recession is still a reality and recovery has usually lagged somewhat in other parts of the world. Industry today in all sectors is worldwide and network providers of EDI services are either offering services in other countries or are not competitive with the top service providers. Because these services are extending worldwide, the impact of the recession will continue to be felt even though the U.S. talks about recovery .

B

Re-engineering

Businesses are continuing to change their infrastructure or re-engineer their organizations in an attempt to achieve high levels of customer service and product quality. To do this, companies must move decision-making to the points of opportunities or problems or, in other words, move information to the point at which decisions are being made.

Such decision making requires accurate information readily available at various locations—intercompany sites, vendors and customer sites. These needs present opportunities for vendors of information services.

C

Manufacturing Changes

Manufacturers approach another level of evolution in their environment, going beyond automation of manual functions and the use of computers in aggregating data. Minicomputers and PCs have previously entered the manufacturing environment and have offered training in automation to personnel and contributed to the building of islands of automation and information.

New applications expanded and refined functionality to more precisely meet the needs of users—now the challenge is to use current technology to incorporate the best part of this last transition. Applications of current technologies will allow the complete integration of data, and the desire to achieve less complex hierarchical management structures.

The next cycle is just around the corner. Open, integrated, comprehensive manufacturing systems will soon occur. They will use object-oriented programming concepts and are database, platform and vendor independent. Manufacturing firms will be able to choose the best parts of various products and incorporate them into use to support daily operations.

D

Role of EDI

EDI and other electronic commerce functionality will be applied to all of the following applications and others: order entry/tracking, general ledger, accounts payable and receivable, billing and invoicing, electronic information distribution, operating system upgrade conversion, payroll and cargo and package tracking, among others. These everyday functions are what make businesses work.

Underlying all of these will be the architecture and foundations built on open systems and client/server models—but riding on top will be software performing these everyday functions. This structure is consistent with the open systems model as defined by the CCITT, and is used to create communication infrastructures—underlying physical and logical networks with business applications residing on top.

E

Implementation Complexities

Manufacturers should look very carefully at the extent to which implementation is completed by the provider and which education and services are offered in their implementation, when buying these applications from providers.

It is safe to assume that the largest telecom carrier or the newest telecom carrier or service provider to the market is the one who is going to best perform this function. In the case of EDI and electronic commerce functions, there are vast complexities of bringing up an entire trading community and fully integrating EDI functions inside the organization once the information has been received. These complexities have not been resolved or overcome by all vendors.

Because of some of these problems, it can be said that the Electronic Commerce market is well established, but has not yet matured. Recent surveys identified almost 400 vendors in this marketplace. That is not the sign of a mature marketplace. However, the future of electronic commerce is very certain because of the forces that we have been describing in this paper.

F

Changes in the EDI Market

The software market may reorganize itself around the open network operating system and, if that is the case, some software providers may disappear. Such a phenomenon may occur in tandem with increasing client/server installations and it is possible that the widespread use of EDI may finally occur after that point.

Many software providers have developed networks of their own and have become full service or solution providers (those providing not only network services, but the software as well). Electronic commerce trading may take a new form and, thus, market consolidation could finally take place once some of these changes have occurred.

We may be on the verge of these changes in the EDI market—maturation and complete market consolidation EDI penetration into the manufacturing sector and its widespread adoption. Many times in the history of EDI rapid growth has been predicted—what has occurred is rapid growth in the number of providers, but not necessarily in the amount of implementation throughout industry sectors. Some of the real problems associated with EDI implementation are addressed and, if the EDI providers who are in that business actually begin to accommodate their customers to a greater extent in solving some of these problems, we will see greater competition as more and more customer s are able to adopt these EDI applications or implementations.

