Market
Analysis
Program
(MAP)

Industry Sector Markets 1991-1996

Process Manufacturing Sector

INPUT®

1280 Villa Street, Mountain View, CA 94041, (415) 961-3300

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INDUSTRY SECTOR MARKETS 1991-1996

PROCESS MANUFACTURING SECTOR

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Purpose and Organization

Purpose and Organization

The purpose of this forecast update is to provide the 1991 INPUT forecasts for the process manufacturing industry sector and a discussion of recent market issues and competitive factors that are influencing the use of information services in this industry. In the 1990 report, a more comprehensive analysis of the components of the process manufacturing sector was presented and should be used as a reference if necessary.

The process manufacturing industry is composed of establishments in the following SIC groups:

SIC Group	Description
20xx	Food and kindred products
24xx	Lumber and wood products
28xx	Chemicals and related products—including paints, soaps, pharmaceuticals, and perfumes
29xx	Petroleum and related industries
30xx	Rubber and miscellaneous plastics products
32xx	Stone, clay, glass, and concrete products
33xx	Primary metal industries

This chapter describes the report purpose and organization. The other chapters of the report are organized as follows:

- Chapter II—Trends, Events, and Issues—describes the current process manufacturing industry and factors that can have an impact on the use of information services.

- Chapter III—Information Services Market—presents information services expenditures by delivery mode for the process manufacturing market.

- Chapter IV—Competitive Environment—provides a review of recent competitive events, and vendor profiles.

- Appendix B—Forecast Data Base—contains a detailed forecast by delivery mode for the process manufacturing industry. It includes a reconciliation of the previous year's forecast.

Related to this process manufacturing sector report are three additional sector reports:

- Discrete manufacturing
- Business services
- Miscellaneous industries

The fifteen INPUT market sector or industry reports and seven cross-industry reports make up INPUT's 1991 Market Analysis Program. Together they provide a complete overview of the U.S. information services industry.

Trends, Events, and Issues

Trends, Events, and Issues

A
Environment and Market Changes

Despite areas of highly successful performance—such as pharmaceuticals and biotech—the process manufacturing industry is suffering from low sales and overcapacity.

- The president of a food manufacturing conglomerate reported that a number of product areas that he has been personally studying—such as soup and ice cream production—have considerably more capacity than they can use in the near future.
- The drive to construct large plants that can take advantage of economies of scale—coupled with low car sales—has left the tire industry in a shambles.
- Low sales have led Goodyear to seek cost savings that include relocating the base of the blimp fleet.
- Chemical manufacturers—such as Union Carbide and Monsanto—have made reductions in IS personnel and other moves to reduce costs.

Overall sales volume is at the root of many of the problems in process manufacturing, and at the end of 1991 there was no sign of an upturn in sales that could revive depressed areas of the industry.

- An upturn in car sales could aid the steel, tire, and plastics markets.
- Revival of house and factory construction should aid steel, plastics, stone, glass, and other process manufacturing products.
- Increased apparel sales would provide work for fiber, yarn, and dyeing plants.

Most manufacturing appears dormant at the present time.

- October factory orders for all manufacturing increased 1.9% over September, according to the Commerce Department. Although this increase reversed a two-month downtrend, orders had still not returned to the level of July 1991.

- The National Association of Manufacturers stated that the low increase for October showed little more than continuing sluggishness.

The November monthly survey of 300 or more purchasing managers by the National Association of Purchasing Managers indicated that the NAPM index of purchasing activity dropped to 50.1.

- A rating below 50% would have been a sign of contraction; 50.1 was not positive enough to signal recovery.

- The November value of the index was the lowest since May. In the months between May and November, purchasing activity increased.

- The data from purchasing managers, which is gathered from a broad range of industrial companies—including all areas of process manufacturing—indicate that manufacturing activity had slowed substantially during the last few months of 1991.

There is a wide disparity in performance among different sectors of process manufacturing, however.

- Despite the sluggish activity in most of the food industry, ConAgra is enjoying high levels of sales and earnings from a carefully selected line of goods that features nutrition-oriented food.

- Despite the favorable performance of many pharmaceutical and biotech firms, the chemical industry is suffering from lower sales. Some chemical manufacturers are downsizing and reducing staff—including IS personnel.

- As noted before, low orders for cars have contributed to a reduced volume of work in steel, tires, and other areas of process manufacturing.

- Yarn and dyeing plants suffered during 1991 as a result of low retail sales of apparel.

The effect of the recession on process manufacturing is different from the effect on discrete manufacturing in terms of company performance and the use of information systems. The differences are due to the products and processes involved.

- Although there are large factories handling the continuous production of steel, aluminum, rubber, plastic, and paper in process manufacturing, there are many more midsized plants than in discrete manufacturing, which produce batches of food, soft drinks, cigarettes, cosmetics, and other consumer goods.

- In discrete manufacturing, fewer firms handle goods consumed regularly by consumers—especially lacking are goods easily delayed in ordering. Discrete manufacturing has more large firms that produce high output.

Consequently, the midsized process firms are more insulated from recessions than other manufacturers—and, relative to discrete manufacturers, do not focus on IS as a way to lower costs or improve productivity.

- Process manufacturers are much more concerned with customization of applications software or new software products to meet particular needs—such as interfacing real-time systems on the plant floor and batch systems in accounting, planning, and control.

- Process manufacturers also engage in the development of more software products to design and set up physical plants and to establish plant information systems for collecting data that can be used for dynamic scheduling and the optimization of factory management operations.

Because of the differences in controlling and managing a continuous process, the software products developed for manufacturing—CAD/CAM, MRP, and MRPII—have not been as heavily utilized in process manufacturing as in discrete, and there has been considerable effort to make these products more responsive to the differences in process applications.

Quality programs are also not receiving quite as much attention in process manufacturing as they are in discrete—partially because there are relatively more large discrete manufacturers, but also because initial research in quality focused on discrete manufacturing in the automotive and electronic industries.

- Some large process firms such as Exxon, however, have indicated that they have a high level of interest in quality programs.

- Large consumer goods manufacturers such as Heinz have used quality programs to improve the consistency of products through quality programs.

- Colgate has reduced costs through the use of quality.

Japanese firms have shown that quality in manufacturing can be a means of creating greater efficiency and lower costs.

Japanese firms have also shown that quality improvements are associated with faster development and production changes. These capabilities are sought by process as well as discrete firms.

In order to achieve improvements in quality, manufacturers have learned that workers and the production process have to be examined.

- The morale and productivity of workers have been improved by making jobs more meaningful and by eliminating levels of management (empowering workers).

- Many of the steps to improve the production process—including the introduction or expansion of robotics and utilization of just-in-time inventory management—have been tuned more to the needs of discrete manufacturing but are also used to some extent in large-scale process manufacturing plants such as those in the steel and industrial-chemical industries.

New applications software products have also been introduced in process manufacturing. These products can gather and analyze more data from the production process and use the data for analysis and dynamic scheduling changes that can improve quality.

In process manufacturing, there also have been many efforts to modify manufacturing software products so that they are more suited to process than to discrete manufacturing—as well as efforts to introduce products developed for process manufacturing.

- Software product firms—as well as professional services and systems integration vendors—have modified CIM, material requirements planning (MRP), and manufacturing resource planning (MRPII) to meet the needs of process manufacturers. Ross Systems—among other companies—has an MRP system for process manufacturing.

- According to respondents, during the last few years there has been growing interest in application systems that meet the unique problems in process manufacturing. The vendors addressing those needs include IBM (POMS), Andersen Consulting (Process/1), and Ernst & Young.

Attempts to improve integration of functions in manufacturing through CIM and other software products have been of interest in process as well as discrete manufacturing, but the primary emphasis in process has been on integrating factory floor and business functions. Large professional services and systems integration firms—such as EDS, CTG, Andersen Consulting, and other Big Six firms—have been involved in attempts to integrate functions.

Questions are being raised about the benefits achieved by process and discrete manufacturers through investments in automation. An article in the fall, 1991 issue of *Sloan Management Review* stated that research on investments in CIM and other automation showed that there were no guaranteed benefits that would justify the investments.

- Management techniques, such as just-in-time, do not appear to be appropriate for a number of companies in process manufacturing—even if the techniques work in others.

- A company's automation approach may have to be analyzed and tailored to meet particular situations and markets.

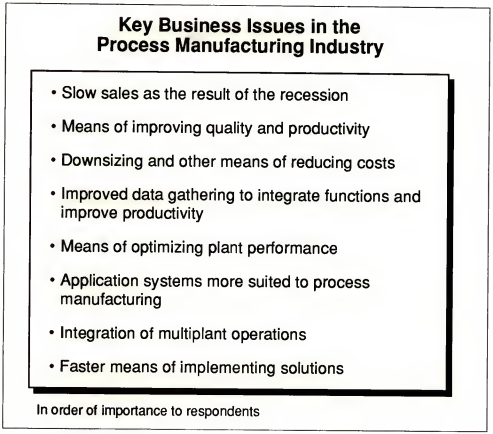
Two research associates of the National Bureau of Economic Research have also stated that the aggressive investment in computerization of manufacturing in recent years has not achieved the payoffs expected.

Several executives at process manufacturers report that these types of questions and reflections have led them to become interested in information services vendors that can discuss problems, provide demonstrations or presentations of ideas, or engage in research on manufacturing functions.

Process and discrete manufacturers are also showing increased interest in research studies and new types of joint efforts with universities that can result in real changes in companies.

Key business issues identified by respondents from the process manufacturing industry are in Exhibit II-1:

EXHIBIT II-1



The process manufacturing industry is composed of approximately 148,000 companies that produce manufactured goods continuously, in a batch process, or by an extraction process such as mining.

Subsections of process manufacturing include metal and coal mining, oil and gas extraction, mining and quarrying of nonmetallic materials, food products, tobacco, textile production, lumber and wood products, paper products, chemicals, petroleum, rubber, plastics, stone, glass, clay, steel, pharmaceuticals, biochemicals, paint, ink, adhesives, and other miscellaneous products.

- An analysis of opportunities for information systems vendors in process manufacturing usually focuses on the automated functions (islands of automation) in process manufacturing.

- However, there are great differences in interests among mining, steel, food, tobacco, pharmaceuticals, etc. Several top managers in major process firms noted that consumer goods are driven by sales; vendors selling to those industries must factor sales into proposals.

The major computing application systems in process manufacturing can be reviewed or analyzed in terms of a model of the automated functions (islands of automation), as outlined below:

- Business operations and planning—including accounting, financial, planning, marketing, sales, and purchasing
- Production/process and plant engineering
- Shop floor control and information management
- EDI and other means of integrating functions and maintenance operations

The major computing application systems in use in the first area above include order entry and processing, sales forecasting, MRP, MRP II, material scheduling and inventory control, product and manufacturing costing, purchasing, and accounting.

- Many of the application products and systems in use in process manufacturing—such as MRP and MRPII systems—are also used in discrete manufacturing but may be modified to meet process needs. J.D. Edwards and Marcam have MRP systems for the process industry.
- A number of these application products and systems were first used on processing services and then offered as software products for mainframes and minis.
- Because interaction with vendors, product modification, and ongoing support have been important factors in the use of application systems in process manufacturing, turnkey vendors such as ASK and systems integrators such as Andersen Consulting have become important in the delivery of services.

Newer systems have business/product planning and shop floor control components such as the GEMMS system of Datalogix and systems that are chiefly aimed at integrating shop floor control with business/product planning—such as POMS of IBM and Process/I of Andersen.

In the production/process development area, some process industry subsections use CAD and CAE products sold in discrete manufacturing. The major application of CAD in the process area is in the design of process plants—including computer-generated piping designs that provide automatic interference checking, piping and instrumentation diagrams, solid modeling, and other calculations.

- CAD products were originally developed by aerospace and software vendors as mainframe and mini software products, but are available now chiefly on turnkey systems and as software products for workstation/PC computers. A product made by Autodesk that runs on workstations/PCs is one of the alternatives for process manufacturing.

- Computer manufacturers have become increasingly important in this market through ownership of software products that enable manufacturers to promote the sale of computer hardware.

Shop floor control applications include plant floor information management or data gathering and the use of a common data base architecture (vertical integration); linkage of the shop floor with engineering and business planning (horizontal integration); and distributed, digital-process-control, computer-aided manufacturing.

Other manufacturing application systems that do not fully coincide with the three functional areas discussed above include manufacturing maintenance, network applications such as EDI, material handling and warehousing, and systems that integrate functions such as CIM.

- Service is provided in some of these application systems areas by information services vendors specializing in particular needs—as Sterling Software does in EDI through software products and network applications.

- There are software products that allow devices and groups to communicate through the use of MAP, TOP, or the OSI model—as well as software products (produced by IBM and SAP) that integrate sets of applications or that attempt to integrate an entire manufacturing environment (computer-integrated manufacturing or CIM) (products of Cimlinc and IBM).

A fully integrated manufacturing environment that allows a data base to be shared among all users in business, factory floor, and engineering areas has proved difficult to accomplish and is being addressed by research in information services firms as well as by manufacturer and university research groups.

Exhibit II-2 lists the key technology trends mentioned by vendors and users involved in the process manufacturing market.

EXHIBIT II-2

Key Technology Trends Identified by Vendors and Users in Process Manufacturing

- More-sophisticated data gathering and management to integrate and manage functions
- Use of systems that help to integrate multisite, multiplatform plant operations with business functions
- Greater use of downsizing, workstations, and client/server technology to manage subfunctions and link them to other sets of functions
- Easier means of modifying or specifying new software products to support changes in manufacturing functions
- Use of outsourcing to address complexity and costliness of use of information systems
- Ability to use and process electronic images of forms

Technology trends mentioned by respondents

The process manufacturing industry needs help in coping with the business issues and technological trends mentioned, and specifically with the steps involved in integrating business management with shopfloor functions.

Vendors have to consider what strategies and tactics should be followed in addressing the market, however.

- Some vendors are finding that they have placed themselves in a position where prospects and clients are demanding more support than vendors can afford to provide. A number of vendors have sought alliances to address this situation.

- Other vendors have tried to carefully define their areas of interest in order to limit the demands of customers for service. Since users report that they want a closer relationship, perhaps even a sole or chief source of support with a vendor, there is a danger that vendors with limited interests might miss opportunities or find that they were bypassed for the products they could have supplied.

The vendors that stand out in the process manufacturing environment at the present time tend to be companies willing to become highly involved with clients and meet a number of needs. Examples of such companies are Andersen Consulting, IBM, EDS, CSC, and DEC.

B

Current Process Manufacturing Events

Major business schools at universities with engineering departments have initiated programs with leading manufacturing companies to develop graduates who can improve manufacturing processes.

- Boeing, Eastman Kodak, and nine other companies have helped to finance this type of effort at MIT. The program has already resulted in improvements in processes, although the main thrust has been to prepare better-trained managers.

- This type of program—which has also been implemented at Penn State, Northwestern, Cornell, and Purdue—has resulted in increased research in manufacturing by faculty members.

At Lehigh University last summer, fifteen executives from leading companies developed a strategic plan for U.S. industry. The conference appeared more oriented to discrete manufacturing, but attendees noted that process as well as discrete manufacturing had to find means of implementing changes more rapidly and increasing productivity.

As a result of the recession, many process manufacturing firms have been consolidating operations and reducing or downsizing IS.

- Union Carbide IS sites have kept their personnel counts flat or cut personnel during the last year.

- Since the 1980s, IS personnel has shrunk 5% at Monsanto, and the central IS data center operation is smaller.

- DuPont is planning to reduce IS expenditures by about $200 million to meet cost-cutting targets of $1 billion in the U.S.

Process manufacturing companies are making major automation moves to reduce costs and/or stimulate business.

- Massive consolidation and downsizing at DuPont will improve productivity and bring more standardization in the use of IS.

- ICI has initiated a program to standardize the use of IS globally and support business expansion.

- In a review of the importance of its heavy investment in IS, Helene Curtis notes that the investment has helped to bring suppliers, manufacturers, and customers closer together.

Information Services Market Forecast

III

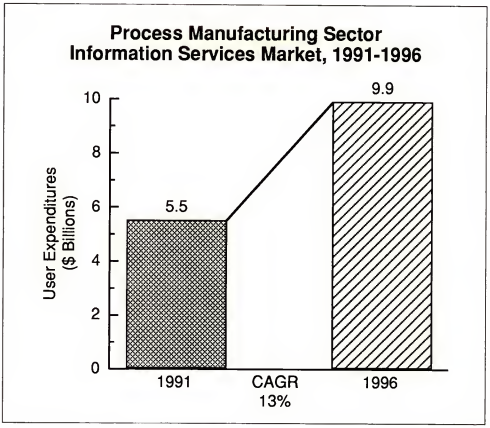
Information Services Market Forecast

A

Total Market Forecast, 1990-1996

As a result of the effects of the recession and global competition on customers, information services expenditures in the process manufacturing industry grew at a slower rate in the U.S. between 1990 and 1991 than in the previous year. The growth rate will increase during the next five years to 13% as Exhibit III-1 shows, but growth in some service modes will remain low.

EXHIBIT III-1



- Expenditures will increase at a rate of 11% from $4.9 billion in 1990 to $5.5 billion in 1991.

- Expenditures will grow at a CAGR of 13% from $5.5 billion in 1991 to $9.9 billion in 1996.

As a result of the recession and increased global competition, the falling rate of orders for manufactured goods led to growth that was 2% below that previously forecast for 1990 and 1% below the rate forecast for growth during the succeeding five years.

Although growth rates for expenditures for information services in process manufacturing are down, INPUT expects vendor opportunities in this industry.

- Process manufacturing is one of the faster growing industry markets for information services.

- The demand for application systems and services that are more suited to process manufacturing will require new software products, work by SI vendors, consulting, and network services.

- Systems integrators and professional services vendors will be needed to help implement new solutions; an increasing number of manufacturers will evaluate the use of outsourcing as a means of meeting challenges in technology.

B

Forecast by Delivery Mode

Exhibit III-2 shows—by delivery mode—the 1991-1996 INPUT forecast for the process manufacturing sector.

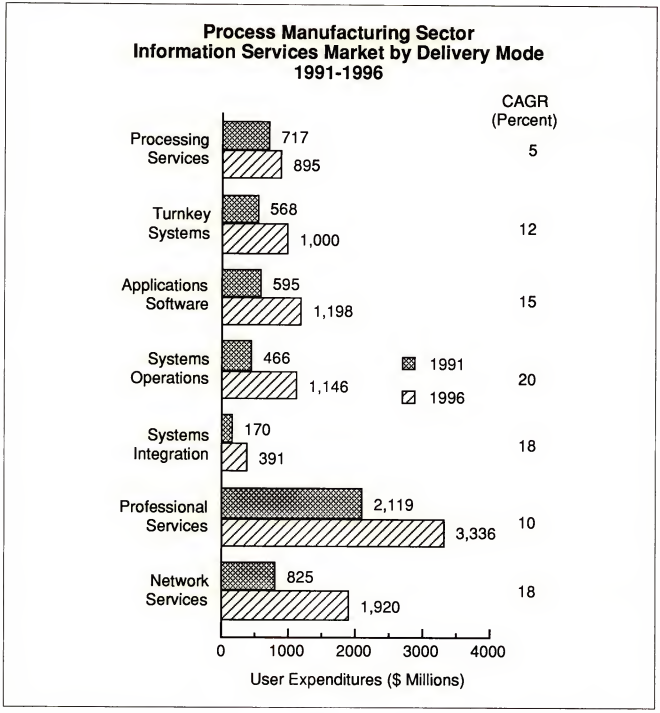
1. Processing Services

Processing services had the lowest growth rate for information services modes in discrete manufacturing in 1991 and are forecast to have the lowest rate between 1991 and 1996. At a CAGR of 5%, processing services will grow from $681 million in 1990 to $717 million in 1991 and then to $895 million in 1996.

The low rate of growth reflects the fact that a number of process manufacturers, particularly smaller ones, are selecting workstation/PC solutions rather than processing alternatives for accounting, inventory, and other problems.

Processing services will continue to be used for periodic jobs that require large-scale resources and to test major software product decisions.

EXHIBIT III-2



2. Turnkey Systems

User expenditures for turnkey systems grew at a rate of 12% between 1990 and 1991—from $509 million to $568 million.

- Among industries other than the federal government, turnkey systems had the second-highest growth rate for 1991 in process.
- Expenditures will continue to grow at a CAGR of 12% between 1991 and 1996—to $1 billion in 1996. Growth in only one other industry will be above this rate.

Expenditures for turnkey systems remain high in process manufacturing because many users are looking for a combination of knowledge, aid, economy, and expendability. ASK and SAP provide such services.

Systems integration and systems operations vendors are appealing to some types of process manufacturers that were formerly interested in turnkey solutions because of the support level provided. Systems integration or operations can provide even more support.

3. Applications Software Products

Expenditures will grow at a rate of 14% between 1990 and 1991 for applications software products; expenditures will climb from $520 million to $595 million. The growth rate or CAGR will rise to 15% between 1991 and 1996, and expenditures will grow to $1.2 billion in 1996.

- The growth of expenditures is forecast to be much higher—23%—for workstation/PC software products.
- The growth rates for mainframe and mini applications software products will be 6% and 11%, respectively, between 1991 and 1996.
- Forecast expenditures will be highest for workstation/PC applications software products—$617 million in 1996. This sum will be greater than the sum of the software product expenditures for minis ($356 million) and mainframes ($225 million).

The favorable growth rate for applications software products and particularly for workstation products is driven by the sale of new offerings for process manufacturing.

- IBM's Process Operations Management System (POMS), which is implemented on the PS/2 and the Datalogix process manufacturing system, which runs on the IBM RS/6000 and other equipment, will help drive workstation/PC software product sales.

- The Process/1 system of Andersen Consulting, which uses DEC mini systems, and the acquisition of a process system by Ross Systems will help drive the use of mini software products. SAP software products will help drive mainframe use.

- The increased forecast for the use of applications software products, particularly for workstations/PCs, is also due to increasing industry interest in client/server applications that allow functions to interconnect.

4. Systems Operations

In 1991, systems operations was the second fastest growing service mode and by 1996 will become the fastest growing delivery mode in process manufacturing.

- The growth rate in 1991 was 18% as user expenditures advanced from $0.4 billion to $0.47 billion.

- Growth will take place more rapidly at a CAGR of 20% between 1991 and 1996; expenditures are forecast to reach $1.1 billion in 1996.

- Growth rates are lower than previous forecasts because of the impact of the recession on contract awards and start dates.

Major outsourcing vendors—such as IBM (Kodak), EDS, and Andersen—have targeted process manufacturing as a source of SO contracts.

5. Systems Integration

In 1991, expenditures for systems integration will grow at a rate of 12%—from $0.15 billion in 1990 to $0.17 billion in 1991. Expenditures will grow at a higher CAGR (18%) between 1991 and 1996; the total will be $0.39 billion in 1996.

- Because of the impact of the recession on funding, particularly for large projects, as well as interest in downsized solutions, expenditures are below previous forecasts.

- Process manufacturing will be a healthy market for systems integration services and a leading target for most of the large systems integration firms such as Andersen Consulting, EDS, IBM, and CSC.

The rapid growth of systems integration and systems operations indicates the high level of user interest in information services that provide closer support and interaction on problems.

- Since the use of SI and SO is appealing in process manufacturing, some vendors such as SAP have made arrangements with a number of the Big 6 vendors in order to have vendor products used in systems integration contracts.

- Datalogix has stated that its strategy in selling software products for this industry will be to work with SI vendors.

6. Professional Services

Although professional services was the largest information services mode in 1990—at a level of $2 billion in user expenditures—the rate of growth of these expenditures in 1991 shrank to 7%, 4% below the rate of growth in the previous year.

- Expenditures grew to $2.1 billion during 1991.

- Professional services will grow between 1991 and 1996 at a CAGR of 10% and will reach $3.3 billion in 1996.

Despite the falling growth rates, the professional services delivery mode will remain the largest mode serving the process manufacturing market. Many of the vendors providing professional services to this industry, particularly the larger vendors, offer other information services that can stimulate the use of professional services.

- Most of the larger professional services vendors in process manufacturing—such as IBM, DEC, EDS, and CTG—also have systems integration business in this industry.

- Several software product vendors with business in process manufacturing also have professional services business in this industry—including ASK, American Software, and Oracle.

Consulting services is the fastest growing submode of professional services in process manufacturing as a result of user interest in research and investigation that will lead to meaningful solutions.

- Large professional services and systems integration vendors—including Big 6 firms—are profiting from this work.

- Booz Allen and McKinsey, firms respected for consulting capabilities, are also profiting from professional services consulting work in process manufacturing.

7. Network Services

Network services is the second largest service mode from 1990 through 1996.

- Growing from $0.7 billion in user expenditures in 1990, network services rose at a rate of 19% to reach $0.83 billion in 1991.
- Between 1991 and 1996, expenditures will increase at a CAGR of 18% to reach $1.9 billion in 1996.

The growth of network services is being driven by the fastest growing submode, network applications. Network applications will have a CAGR of 35% between 1991 and 1996.

The mushrooming use of EDI and electronic commerce to support ordering and payment to suppliers and from some customers is necessary to support faster and/or more flexible means of linking work.

The use of on-line data bases (EIS) with technical, economic, and financial information is also growing at a fast rate in process manufacturing.

Competitive Environment

Competitive Environment

A

Recent Information Services Events

During the recent past, a group of products has been announced and sold that are focused on process manufacturing. In addition, significant orders of products and services aimed at both discrete and process manufacturing have been sold in process manufacturing. Significant alliances, mergers, and acquisitions have been made by vendors serving the process industry. Events that characterize the dynamic nature of this vertical market are included in this section.

Products aimed at process manufacturing have been introduced by a group of vendors—including Andersen Consulting, IBM, Ross Systems, Datalogix, and Palette.

- The IBM product, Process Operations Management System (POMS), shipped in 1990 and is installed at over 40 companies—including Nestle Foods, Campbell Soup, SmithKline Beecham, and Johnson & Johnson. POMS is implemented on the PS/2 and allows users to share information from factory floors with business areas of production.

- The Andersen product—Process/1, which runs on the DEC VAX/VMS platform—provides an interface between process control devices on the plant floor and corporate, enterprise-level business systems. Process/1 handles multiplant, multihost systems and provides environmental health-and-safety features.

- The recently announced Global Enterprise Manufacturing Management System (GEMMS) of Datalogix manages process manufacturing functions across multiple hardware platforms and plant locations. The system—which operates on the IBM RS/6000, DEC VAX, and HP computers—is being used at beta test sites by Monsanto, Sun Chemical, and Quaker Oats. The system is a manufacturing resource product designed for process manufacturers with multiple locations.

- Promix, the process manufacturing system announced by Ross Systems, was obtained through the acquisition of Pioneer Computer in the U.K. Ross systems noted that there was a need for systems developed specifically for the process industry that would integrate control and process information with business and planning manufacturing functions.

The Datalogix system, discussed above, is being installed at Sun Chemical with the aid of Ernst & Young. Datalogix intends to work with other Big 6 firms and integrators in the sale and implementation of this product.

Big 6 firms have also formed alliances with SAP in order to take advantage of the capabilities of SAP systems for process and discrete manufacturers. A notable installation of SAP software products has been made in the process industry at ICI, the fourth largest chemical company in the world, where SAP systems have been used on a wall-to-wall basis around the world.

New products and services that are aimed at both process and discrete manufacturers include the new offerings of Oracle. Oracle's new manufacturing system that will compete with existing MRP systems has been tested at four customer sites.

- Oracle will support the product with consulting services and will make arrangements with Big 6 firms and other integrators and VARs so that they can represent the product.

- Advantages that the product will have include its availability on multiple hardware platforms and use of relational data bases, CASE tools, and 4GL and graphics capabilities.

EDS strengthened its general-manufacturing capabilities by acquiring McDonnell Douglas SI Co., investing in ASK, and forming alliances with Consilium and Sherpa Corp. EDS plans to build an all-encompassing manufacturing services capability.

In support of its general manufacturing capabilities, IBM began to ship the CIM/400 software product that enables users of the AS/400, RS/6000, and PS/2 to share information concerning design, business, and plant floor systems during the fall of 1991.

Hewlett-Packard has been releasing software tools that enable data to be exchanged between CAD, MRP, and production applications systems using HP computers and a version of UNIX. HP has plans to interface these tools to a number of computers from other vendors.

B
Vendor Profiles

A number of different types of information services vendors active in the process manufacturing industry are profiled in this section. Strategies, background information, and products and services of these vendors are reviewed to explore the range of competition in the industry.

A number of vendors concentrate on a limited set of capabilities in one or a few functional areas or service modes in process manufacturing:

- SAS—which concentrates mostly on cross-industry analytical software products—has developed a pharmaceutical-industry product that will help analyze and present information on new drugs.

- GEIS provides EDI and VAN network applications services to process manufacturers.

Other vendors are more interested in marketing a group of information services products and services that can meet a wide range of needs of customers and prospects.

- Andersen Consulting, Ernst & Young, and other Big Six firms—as well as vendors in the information services industry—are attempting to meet a wide range of needs in many types of process manufacturing.

- Through the acquisition of MDSI and several other vendors, EDS announced that it had strengthened its ability to offer a wide range of services to manufacturing.

The larger vendors, such as the ones mentioned above, serve a number of other markets as well as process manufacturing. There are many small vendors—such as Palette and Factorial Systems—that serve only manufacturing customers.

In addition to the companies profiled, many other information services vendors serve the process manufacturing market—including IBM, NCR, DEC, and GEIS.

Companies profiled include:

- American Software, Inc.
- Andersen Consulting
- ASK Computer Systems, Inc.
- Computer Task Group, Inc.
- Datalogix International, Inc.
- Dun & Bradstreet Software Services, Inc.

- Factorial Systems, Inc.
- Palette Systems, Inc.
- Sterling Software, Inc. - EDI Group

Additional information about these companies or other companies active in process manufacturing can be found in INPUT's Vendor Analysis Program.

1. American Software, Inc., 470 East Paces Ferry Rd., Atlanta, GA 30305, (404) 261-4381

a. Company Strategy

American Software has developed an integrated line of standard applications software products for IBM mainframe and AS/400 platforms. These products run singly or in combination to meet unique customer requirements.

- These products have been supplemented to meet the needs of installations in particular industries, particularly manufacturing.

- American Software will perform professional services work to customize its software products to solve customer problems in process or discrete areas.

In addition to a set of manufacturing modules, American Software can offer a full MRPII system for IBM mainframes and minis.

b. Company Background

American Software was founded in 1970. The company grew to around 750 full-time employees in 1990, and its calendar year revenues for 1990 reached almost $100 million. The company provides applications software products and professional services to manufacturing, distribution, utilities, banking and finance, health care, education, transportation, and government clients.

c. Products and Services

About 37% of American Software's revenues are provided by professional services and 13% came from maintenance of software products that could be included as part of professional services.

- As shown above, about half of the company's revenue is from professional services.

- American Software is one of the most successful software product vendors in marketing professional services.

The applications software products that are sold can be divided into two groups:

- Forecasting and inventory management software that accounts for about 8% of revenue
- Purchasing, materials control, and financial software that accounts for about 38% of revenue

Specific manufacturing modules include master scheduling, materials requirement planning, bill of materials, capacity planning, production work status, shop floor control, and cost management and tracking.

2. Andersen Consulting, Arthur Andersen & Co., 69 West Washington Street, Chicago, IL 60602, (312) 580-0069

a. Company Strategy

Andersen utilizes its reputation in manufacturing and its demonstrations of working solutions to manufacturing and distribution problems as a means of appealing to, and closing business with, prospects that are solution oriented. Andersen focuses more attention on manufacturing than on other markets, but has extended its capabilities to retail and wholesale distribution—as well as to banking, utilities, and other markets.

In process manufacturing, Andersen has introduced a unique system that will link plant floor and business functions and provide new types of capabilities in the environmental area. Andersen will use this system, Process/1, as a means of introducing additional products aimed at the business/production management area.

Andersen emphasizes its knowledge of industries and applications, particularly in manufacturing and distribution, to make presentations and conduct consulting studies that can lead to large SI and professional-services contracts. By means of studying the performance and problems of companies in its areas of interest, Andersen has been able to suggest opportunities to gain revenues and improve earnings at companies that it contacts. The firm uses acquisitions and alliances to gain additional resources and knowledge to address its areas of interest.

b. Company Background

Andersen Consulting was set up by Arthur Andersen & Co. as a separate firm in 1988 to address its rapidly growing and large volume of information services business. Estimated worldwide revenues in 1990 for Andersen Consulting were $2.12 billion, 30% above revenue for 1989. In 1990 U.S. revenues increased by about 21%—to $1.23 billion.

c. Key Products and Services

Over half of 1990 revenue derived from systems integration and about 25% from professional services. Systems operations revenue increased to about 8% of revenue in 1990, and revenue was also obtained from applications and systems software products and network services.

Areas of manufacturing expertise include CIM, CAD/CAM, MRPII, robotics, material handling, numerical control, bar code data collection, and change management control.

3. ASK Computer Systems, Inc. 2240 W. El Camino Real, P.O. Box 7640, Mountain View, CA 94039-7640, (415) 969-4442

a. Company Strategy

ASK was devoted completely to the manufacturing industry prior to the acquisition of Ingres and still maintains more focus on manufacturing than do most competitors. ASK offers turnkey systems and software products for HP, IBM, and DEC midrange computers—as well as a processing service—that provide integrated manufacturing capabilities for discrete and process manufacturers.

- Prospects can avail themselves of the support provided with processing or turnkey systems or buy software products for their own equipment. Clients can choose more reliance on a vendor if they wish—which is important in the process industry.

- Prospects also are provided with an image of a vendor that understands manufacturing and that has a full set of products for manufacturing planning, forecasting, budgeting, tracking, linking, purchasing, accounting, and other functions that use a common data base.

b. Company Background

ASK was incorporated in 1974 to serve the manufacturing industry. It has acquired several companies that enabled it to extend the hardware platforms, software products, and clients that it served.

Turnkey systems and software products for IBM, DEC, and HP midrange computers are the chief sources of revenue for ASK, but ASK also provides processing services and a small amount of systems integration services.

c. Products and Services

The primary offering of ASK is an on-line interactive system (the MANMAN Information System) that consists of integrated products for manufacturing, finance, marketing, customer service, decision support, and computer-integrated manufacturing functions.

4. Computer Task Group, Inc., 800 Delaware Avenue, Buffalo, NY 14209, (716) 882-8000

a. Company Strategy

CTG utilizes its strength and experience in delivering a variety of professional services to meet a range of problems—from large, complex jobs to tasks requiring high-level technological skills. Capabilities have been developed to support systems integration and network development.

CTG can bring its strengths to bear in a number of industries—including discrete and process manufacturing, business services, banking and finance, insurance, and state and local government. CTG has considerable knowledge of the implementation of MRP and MRPII systems.

b. Company Background

Computer Task Group, founded in 1966, is one of the largest vendors of professional services. The company concentrates on markets other than the federal government. It provides systems integration services as well as professional services. U.S. revenues were $232 million in 1990.

In 1989, IBM made an investment in CTG and has used CTG's systems engineers on work for IBM and IBM clients.

c. Key Products and Services

Over 80% of 1990 revenue was from professional services, and the balance was systems integration work and a small amount of systems operations work. CTG provides consultants experienced in industry problems as well as in technology. This combination of expertise is attractive in process manufacturing.

- CTG's staff can augment the staff of a client and become part of the project team on a specific project, or CTG can manage and staff an entire project.

- CTG has experience in supporting large clients on a single-site, multiple-site, domestic, or worldwide basis.

5. Datalogix International, Inc. 100 Summit Lake Drive, Valhalla, NY, 10595, (914) 747-2900

a. Company Strategy

Datalogix has introduced a product, GEMMS, to address needs that are not fully met in the process manufacturing industry—chiefly the ability to provide manufacturing resource planning capabilities to handle multiple factories or divisions.

In order to penetrate the process market successfully, Datalogix will use alliances with Big Six companies and other integrators as well as implementations on IBM, DEC, and HP midrange platforms.

b. Company Background

Datalogix was formed in 1981 to develop and market applications software products to the process manufacturing industry.

c. Products and Services

Datalogix has sold software products that provide formula management and other functions to the food, beverage, coatings, chemical, and pharmaceutical industries.

Datalogix's recently announced major product, Global Enterprise Manufacturing Management System (GEMMS), handles formula management, inventory, production management, sales order processing, product costing, and purchase order management. GEMMS is a process industry MRPII system implemented on IBM RS/6000, DEC VAX, and HP computers.

6. Dun & Bradstreet Software Services, Inc., 550 Cochituate Rd., Framingham, MA 01701, (508) 370-5000

a. Company Strategy

The company develops, markets, and supports a wide range of industry and cross-industry software products on multiple-vendor platforms that provide the opportunity to market to a number of industry markets.

- Applications software products are available for finance and accounting; human resources; and administrative, purchasing, inventory, manufacturing, education, and health industry functions. Manufacturing business accounts for 45% of company revenues.

- The AMAPS systems support discrete and process manufacturing environments on multiple-vendor platforms. A program is available to develop interfaces with the manufacturing software products of other vendors.

In addition to AMAPS systems, process manufacturers use Dun & Bradstreet software products for inventory control, human resources, accounting, financial reporting, and other standalone applications. Dun & Bradstreet also provides professional services aid in planning, using, and customizing software products.

D&B's software products utilize a number of hardware platforms—including IBM, Unisys, DEC, HP, and Bull mainframe and midrange equipment.

b. Company Background

This company is a subsidiary of the Dun & Bradstreet Corporation. It was formed in 1990 as a result of the merger of Management Science America, which D&B acquired in 1990, and McCormack & Dodge, which D&B acquired in 1983. The former had been founded in 1963 and had over 24,500 product installations. The latter, founded in 1969, had over 10,000 product installations.

c. Products and Services

This vendor's software addresses a number of functions, as described in the following material:

- The Millennium Series supports human resources, accounting, and support functions—chiefly on IBM and compatible mainframes, but some products are also available for DEC VAX computers.
- The PLUS series offers accounting and a micro-to-mini link for IBM AS/400s and system/38s.
- Human resources products are available for IBM and compatible PCs.
- The BrightView Series—which allows the use of intelligent workstations and which addresses accounting, inventory, and budgeting functions—uses IBM mainframe and 9370 computers.
- The AMAPS manufacturing software products, which also can use intelligent workstations, are available for IBM mainframe and minis, and for HP computers.
- Software products are also available for education and factory operations and other functions.

7. Factorial Systems, Inc., 6300 Bridgepoint Parkway, Austin, TX 78730, (512) 345-1192

a. Company Strategy

Factorial was founded to provide manufacturing control systems solutions applicable to job shop, repetitive, or continuous-flow processing. The capabilities that the company uses to achieve this objective include:

- The expertise and experience of its employees in implementing factory management-and-control solutions

- Research-and-development partnerships in the academic environment
- The ability to provide high-level consulting services, in addition to software products
- A proven factory management-and-control software system acquired from Tandem that has been improved and upgraded to provide workflow, material services, and labor services capabilities

b. Company Background

The company was founded in 1985 to provide manufacturing control systems. It operates out of one location and has fewer than 20 people, but has business in other regions of the U.S.

c. Products and Services

The software system that Factorial originally acquired from Tandem has been generalized and provided for workstations/PCs running under OS/2, as well as for Tandem computers running under Guardian and SQL.

The system, now called the Paperless Factory System, includes:

- A knowledge-based management and control system that provides on-line tracking, routing, data collection, resource management, quality control, configuration management, and interfaces to other systems and equipment
- A material control system that provides just-in-time and traditional methods of inventory replenishment—as well as inventory management, control, accounting, and other functions
- A time-and-attendance and labor-reporting system that operates on a standalone basis or integrated with the functions above

8. Palette Systems, Inc., 6 Trafalgar Square, Nashua, N.H. 03063, (603) 886-1230

a. Company Strategy

Palette is attempting to establish itself as a software product vendor for DEC equipment in the process and discrete manufacturing industries through the introduction of unique product solutions to existing problems.

- Palette is a product that uses text and graphics programs for computer-aided process planning, factory display and data collection, quality control, and rework instructions. These programs can be used in the chemical, pharmaceutical, automotive, electronic, and semiconductor industries.

- Electronic Batch Records System is a hypertext system for controlling pharmaceutical manufacturing processes. This system provides electronic forms that are modeled after paper forms to provide shop floor workers with instructions and to collect batch information for business management purposes.

b. Company Background

The company was established in 1983 to develop applications that would extend the capabilities of DEC software and hardware products.

c. Products and Services

These are generally described in relation to the company's strategy. An additional product handles electronic work instructions and works with the Engineering Data Control system of DEC.

9. Sterling Software, Inc. - EDI Group, 4600 Lakehurst Court, P.O. Box 7160, Dublin, OH 43017, (614) 793-7000

a. Company Strategy

Sterling's EDI Group has developed and acquired a comprehensive set of EDI services and related software and services that have established the company as a major competitor and source of expertise in EDI.

As part of its strategy, the EDI Group focuses on maintaining a close relationship with clients and supplying their needs as their use of EDI expands. This strategy is supported with education and participation in the largest user group active in the EDI market.

Markets that the EDI Group has penetrated include wholesale and retail distribution—including grocery, hardware, and housewares as well as pharmaceutical, medical/surgical distribution, and service merchandising.

b. Company History

The EDI Group was created in October, 1990 and includes the ORDERNET Services Division, the EDI Labs Division, and an EDI International Division headquartered in London. The REDINET Services Division of CDC was acquired in 1991 and folded into the ORDERNET Division. Fiscal year 1990 revenues were over $23 million; 85% derived from the U.S.

c. Products and Services

About 55% of the EDI Group's revenue derives from software products and 45% from network services. Software products and network services are offered though the ORDERNET division to over 2,700 customers in

the pharmaceutical, grocery, hardware, housewares, retail, medical distribution, mass-merchandising, warehousing, transportation, and automotive industries.

ORDERNET provides an on-line network to manage and control the flow of standardized business documents among over 2,000 trading partners.

Services to certain industries are provided through vendors active in those industries. ORDERNET services are made available to hospitals through GTE Health Systems. Services—including a data base on drug usage—are made available to the medical industry through International Health Applications.

Internetwork traffic for the grocery industry is supported through BT Tymnet.

Electronic transmission of chargeback information between wholesalers and pharmaceutical manufacturers is provided in three formats established by national druggists' associations.

Translation between established standards for EDI and other standards and between a variety of record formats—as well as support of existing protocols on different hardware platforms—are provided with software from the EDI Group.

A data base service is also available to build on EDI documents—including purchase orders and invoices that trading partners use during business.

Security services, education, and software maintenance are also offered in support of EDI products and services.

Appendixes

Definitions

No industry-specific definitions have been used in this report.

See the separate volume, INPUT's *Definition of Terms*, for general definitions of industry structure and delivery modes used throughout INPUT reports.

Forecast Data Base

A
Forecast Data Base

Exhibit B-1 presents INPUT'S 1991-1996 market forecast for the process manufacturing sector.

EXHIBIT B-1

Process Manufacturing Sector
User Expenditure Forecast by Delivery Mode, 1990-1996
($ Millions)

Delivery Modes	1990 ($)	Growth 90-91 (%)	1991 ($)	1992 ($)	1993 ($)	1994 ($)	1995 ($)	1996 ($)	CAGR 91-96 (%)
Sector Total	4,930	11	5,460	6,111	6,872	7,741	8,733	9,886	13
Processing Services	681	5	717	743	778	815	853	895	5
- Transaction Processing	681	5	717	743	778	815	853	895	5
Turnkey Systems	509	12	568	634	709	793	889	1,000	12
- Equipment	244	12	273	304	340	381	427	480	12
- Software Products	183	12	204	228	255	285	320	360	12
- Applications	158	12	176	197	220	246	276	310	12
- Systems	25	12	28	32	35	40	44	50	12
- Professional Services	81	12	91	101	113	127	142	160	12
Applications Software Products	520	14	595	683	783	899	1,036	1,198	15
- Mainframe	157	8	169	182	193	203	212	225	6
- Minicomputer	185	12	207	231	258	288	322	356	11
- Workstation/PC	178	23	219	270	332	408	502	617	23
Systems Operations	395	18	466	559	674	807	960	1,146	20
- Platform Sys Oprns	176	18	208	249	289	330	369	413	15
- Applications Sys Oprns	219	18	258	310	385	477	591	733	23
Systems Integration	152	12	170	192	225	270	324	391	18
- Equipment	67	12	75	84	99	119	143	172	18
- Software Products	9	12	10	12	14	16	19	23	18
- Applications	5	12	5	6	7	8	10	12	18
- Systems	5	12	5	6	7	8	10	12	18
- Professional Services	71	12	80	90	106	127	152	184	18
- Other	5	12	5	6	7	8	10	12	18
Professional Services	1,977	7	2,119	2,324	2,546	2,788	3,050	3,336	10
- Consulting	461	11	510	591	678	773	882	1008	15
- Software Development	1250	5	1310	1386	1474	1568	1589	1760	6
- Education & Training	266	12	299	347	394	447	579	568	14
Network Services	696	19	825	976	1,157	1,369	1,621	1,920	18
- Electronic Info Svcs	610	16	708	818	941	1,072	1,215	1,400	15
- Network Applications	86	36	117	158	216	297	406	520	35

B
Data Base Reconciliation

Exhibit B-2 presents the 1991 MAP data base reconciliation for the process manufacturing sector.

EXHIBIT B-2

Process Manufacturing Sector
1991 MAP Data Base Reconciliation
($ Millions)

Delivery Modes	1990 Market				1995 Market				90-95 CAGR per data 90 rpt (%)	90-95 CAGR per data 91 rpt (%)
	1990 Report (Fcst) ($)	1991 Report (Actual) ($)	Variance from 1990 Report ($)	Variance from 1990 Report (%)	1990 Report (Fcst) ($)	1991 Report (Fcst) ($)	Variance from 1990 Report ($)	Variance from 1990 Report (%)		
Total Process Manufacturing Sector	5,074	4,930	-144	-3	9,702	8,733	-969	-10	14	12
Processing Services	678	681	3	0	882	853	-29	-3	5	5
- Transaction Processing	678	681	3	0	882	853	-29	-3	5	5
Turnkey Systems	509	509	0	-	889	889	0	-	12	12
Applications Software	535	520	-15	-3	1,069	1,036	-33	-3	14	14
Systems Operations	522	395	-127	-24	1,113	960	-153	-14	17	18
Systems Integration	157	152	-5	-3	412	324	-88	-21	21	16
Professional Services	1,977	1,977	0	-	3,729	3,050	-679	-18	14	9
Network Services	696	696	0	-	1,608	1,621	13	1	18	18

The user expenditures for 1990 are close to the previous forecast—except for the systems operations mode, which is 24% below the forecast. The recession, and possibly the Gulf War, had a severe impact on the initiation of projects, particularly in energy and petrochemical industries.

The delay mentioned above had an impact on the forecast of systems operations through 1995, although systems operations are forecast to grow at a very healthy CAGR of 20% between 1991 and 1996. In 1995, the forecast of the market was reduced by 10% to account for the effect of the delay, as well as to account for reductions in the rate of growth for systems integration and professional services expenditures.

Systems integration suffered a severe reduction from its forecast growth rate of 21% in 1991—to an estimated rate of 12% because of the impact of the recession.

- INPUT lowered the forecast growth rate through 1995 from 21% to 16% to account for slower growth of systems integration.
- This slower growth resulted in a reduction of $88 million—or 21%—in the forecast growth for 1995.

One of the reasons for the reduced rate of growth in SI is the tendency of some SI vendors to share jobs with software product and turnkey service vendors in process manufacturing.

The growth rate of 18% in systems integration still makes it one of the faster growing modes of process manufacturing.

Because of the continuing impact of the recession and the maturity of these modes of service, processing services and applications software products show small reductions in user expenditures in 1995 versus previous forecasts.

Professional services show a much larger reduction of 18%—or $679 million in 1995. The explanation is the economic downturn, the maturity of the mode, the movement of work to other modes—including SO, turnkey systems, and SI—and the use of downsized solutions and workstation/PC software products.